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The ELECTRICAL REVIEW

FOUNDED 1872

VOL. CXVII
No. 3025

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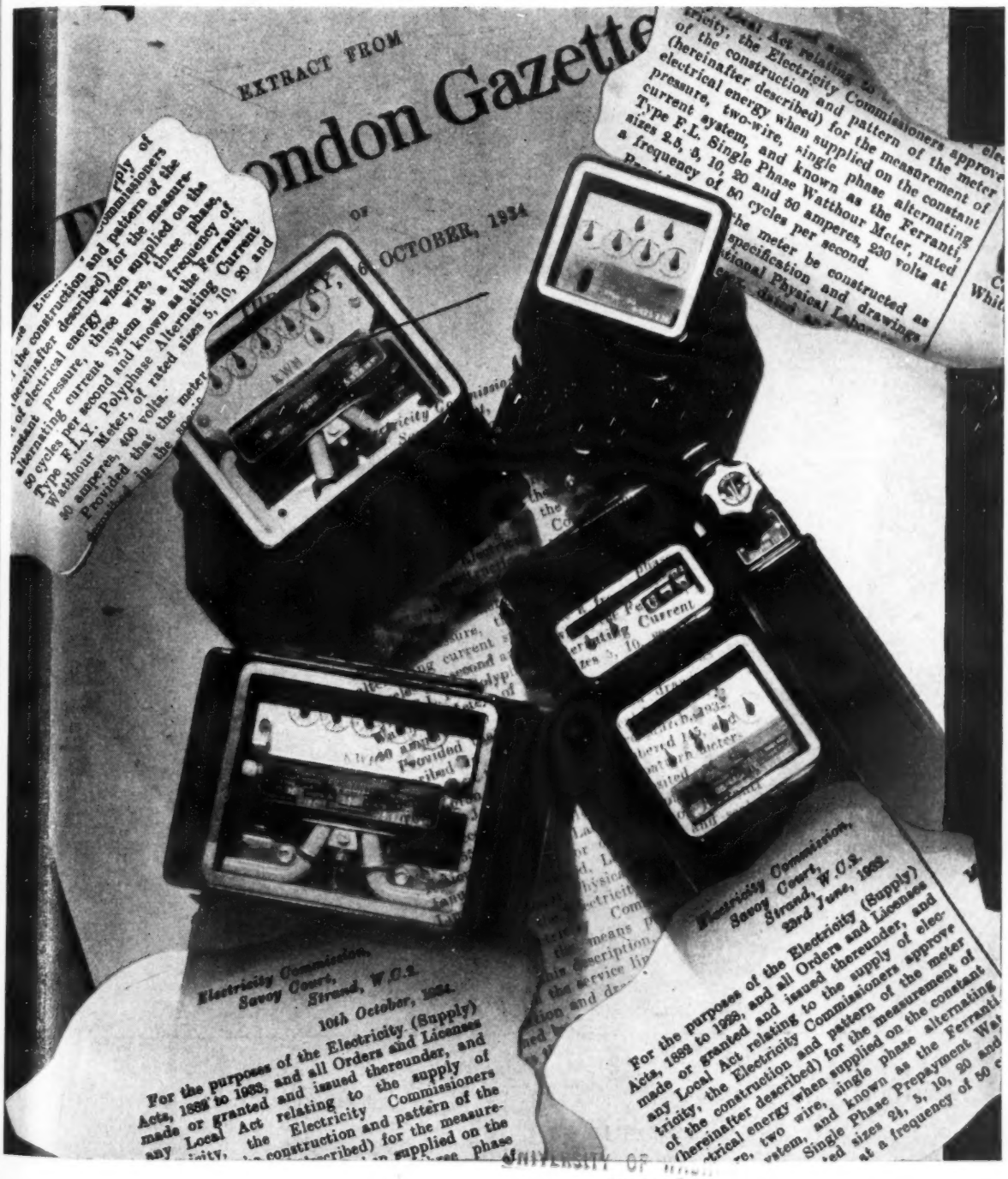
EXTRACT FROM
London Gazette
OCTOBER, 1934
Electricity Commission,
Savoy Court,
Strand, W.C.2.
10th October, 1934.
For the purposes of the Electricity (Supply) Acts, 1882 to 1933, and all Orders and Licenses made or granted and issued thereunder, and any Local Act relating to the supply of electrical energy when supplied on the constant pressure, two-wire, single phase alternating current system, and known as the Ferranti, Type F.L. Single Phase Watthour Meter, rated sizes 2½, 5, 10, 20 and 50 amperes, 230 volts at a frequency of 50 cycles per second.
Electricity Commission,
Savoy Court,
Strand, W.C.2.
23rd June, 1933.
For the purposes of the Electricity (Supply) Acts, 1882 to 1933, and all Orders and Licenses made or granted and issued thereunder, and any Local Act relating to the supply of electricity, the Electricity Commissioners approve of the construction and pattern of the meter (hereinafter described) for the measurement of electrical energy when supplied on the constant pressure, two wire, single phase, three phase, 50 cycles per second and known as the Ferranti, Type F.L.Y. Polyphase Alternating Current Watthour Meter, of rated sizes 5, 10, 20 and 50 amperes, 400 volts.

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SEATTLE

Perfect Combustion demands Temperature Time and Turbulence :
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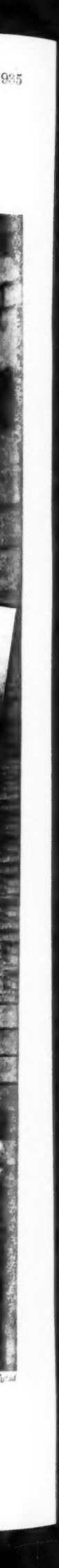
WHERE ONE BAILEY WALL IS INSTALLED OTHERS GENERALLY FOLLOW



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The
Electrical Review

VOL. CXVII. NOVEMBER 15, 1935. No. 3025.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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What is Suburban Electrification?

THERE seems to be general agreement that the electrification of suburban railways is not only profitable but also necessary, if we are to cope adequately with heavy local passenger traffic. Views as to what constitutes suburban conditions, however, differ considerably.

Obviously, the operation of the London Underground Railways, for instance, would be impracticable without electricity, and it is almost equally clear that the frequent services required for bringing into town residents from the suburbs owe everything to the high acceleration obtainable only by the same means.

Below the traffic density at which electricity has a virtual monopoly, comparisons of cost become of increasing importance, but there is still a wide margin in which electric propulsion is accepted as the best system on all counts. This margin tends to become wider as experience of railway electrification all over the world grows; in other words, the critical point of traffic density tends to become less.

The Weir Committee pointed out in 1931 that the average density of typical suburban schemes is but little greater than that of a considerable mileage of main lines.

It is not always appreciated that the Weir Report dealt in bulk with the conversion of steam lines over a period of twenty years, and that the expenditure covered many cases which, taken by themselves, would yield too low a return to justify full electrification. There are, however, many separate sections the conversion of which would pay handsomely.

Such examples are to be found chiefly in inter-urban services (such as the proposed Manchester-Sheffield scheme reported by us last week), and one of the best points made in the new E.D.A. pamphlet "The Case for Electrification of the Railways" is the differentiation between usual inter-urban and main-line conditions, as the former, especially under electrification, tend to resemble suburban conditions.

This brings us to an argument which is outside the scope of the E.D.A. survey, but which exercises an influence greater than its relevance appears to warrant. The railways now use more coal than is required for generating the whole output of statutory electricity undertakings, and the economy obtained by combustion in base-load stations would represent a loss of freight.

Electrification, however, would enable trains to be run more frequently for relatively long distances, and this would do even more than high speeds to encourage the travelling habit and to regain some of the traffic lost to the roads. Ultimately this would do much towards keeping the fuel consumption at its present figure.

The special circumstances that have been adduced to account for greater progress in railroad electrification abroad are shown in the E.D.A. pamphlet to be relatively unimportant. On the other hand, in the outstanding factor of traffic density circumstances in this country are distinctly favourable.

The suggestion of an American engineer that our railway electrification problem is essentially a suburban one may be somewhat of an exaggeration, but it does, at any rate, illustrate the scale of values in Great Britain, where the electrification of very many miles of inter-urban lines could undoubtedly be put in hand with advantage.

A Useful Film

ONE of the most powerful agents for instilling ideas into the public mind is the cinema, but, unfortunately, it is used more often than not for inculcating ideas of doubtful value. While we would not suggest that "Hollywoodism" should be superseded entirely by education, there is ample room for matter of real value. The type of film which we have in mind is "The Face of Britain," which is mentioned on page 666 of this issue. While the E.D.A. films are undisguised propaganda, this picture is of general interest; nevertheless, its electrical message is a most forcible one and most attractively presented. Even hardened electrical journalists at a private view last

week were given a clearer realisation of the great future of electricity in the regeneration of Britain. We who are in the centre of the industry are apt to have our attention wholly occupied by the affairs of the moment, and it is refreshing to have the wider view which this film records.

Advance of the Trolley-bus

EVEN with nothing else in its favour, the fact that the substitution of the trolley-bus for the tram does not involve the loss of the traction load on the power-station gives the trolley vehicle a strong priority over petrol buses when tram abandonment schemes are under consideration. With the additional recommendation of greater flexibility and comfort and almost complete lack of noise, not to mention fumes, an extended use of this type of vehicle seems assured. The London Passenger Transport Board, as well as many other transport undertakings, is now engaged on a large-scale change-over scheme, and we have no doubt that many municipalities not already "trolley-bus minded" will follow its example. A visit to the Commercial Motor Show has convinced us that manufacturers of trolley-buses are fully alive to the promising outlook, and are preparing for a large increase in demand by producing new models and further improving existing vehicles.

Begging the Question

IN a circular purporting to give an "explanation" of the gas "unit," the South Metropolitan Gas Co., after defining the British thermal unit and telling its readers how exact and scientific it all is, goes on to point out that the therm (100,000 B.th.u.) is too large a quantity to compare easily with the unit of electricity (3,412 B.th.u.). It is, it states, "most desirable to know *exactly* what each method costs." We agree—and the italics are ours. Here, however, the "explanation" stops. The reader is arbitrarily told that the gas unit is equal to 4,000 B.th.u., and is left to deduce that the difference between this mystic number and 3,412 is a measure of the relative efficiencies of gas and electricity. Actually he will be lucky if the over-all losses with gas are not between three and four times those obtained from this simple arithmetical calculation. In other words, the gas unit, to be comparable in practice with the electrical unit for cooking and heating, would have to contain more than 8,000 B.th.u.

E.H.P. Steam Plant

A REPORT of the Bradford Electricity Committee for the year that ended last month contains some particulars of the operation of the 1,100 lb. per sq. in. plant which Mr. T. Roles, the city electrical engineer, installed in Valley Road station. This ran for 1,250 hours during the period and was opened up for annual inspection in August. The excellent condition of the turbine showed that the early troubles due to corrosion have been quite overcome. As regards the boiler plant, the cause of some deterioration of the reheater supports is being investigated, but the real difficulty has been in maintaining the refractory lining of the furnace, which has necessitated the putting of the boiler out of service at somewhat frequent intervals. Less than ten years ago failures of refractories in many stations were giving concern under conditions that are now considered normal, but we hear little of these now. As the high-pressure parts of the Bradford installation apparently give no trouble, it would appear that once again the metallurgist is in advance of his collaborator in furnace design.

Keeping to the Point

A WELCOME innovation was made at the last I.E.E. meeting. The President proposed a vote of thanks to Mr. A. L. Lunn immediately after the presentation of his paper, thus anticipating (with a view to preventing) those individual expressions of appreciation in the subsequent discussion that have in the past occupied too much of the limited time that can be allocated to any one speaker. Surely the most sincere tribute that one can pay to an author is to devote every moment available to the discussion and criticism of his paper. We hope that the departure from custom initiated by Mr. J. M. Kennedy will be taken as a precedent.

Mining-type Transformers

SOME useful data regarding underground transformer practice in collieries was given by Mr. A. W. F. Richards in his presidential address on Tuesday to the London Branch of the Association of Mining Electrical Engineers. The departures from recommended standards in many respects would seem to indicate the need for a revision of B.S.S. No. 355 (Mining-type Transformers) to follow the new edition of the specification now known as No. 171 (Electrical Performance of Transformers for Power and Lighting), the issue of which is expected shortly. Any modifications made will be only for convenience, as improvements in the direction of safety and reliability are hardly to be expected. In spite of rough conditions of use, Mr. Richards points out that during the last ten years transformers have been involved in no fatal accidents in mines.

Intense Magnetic Fields

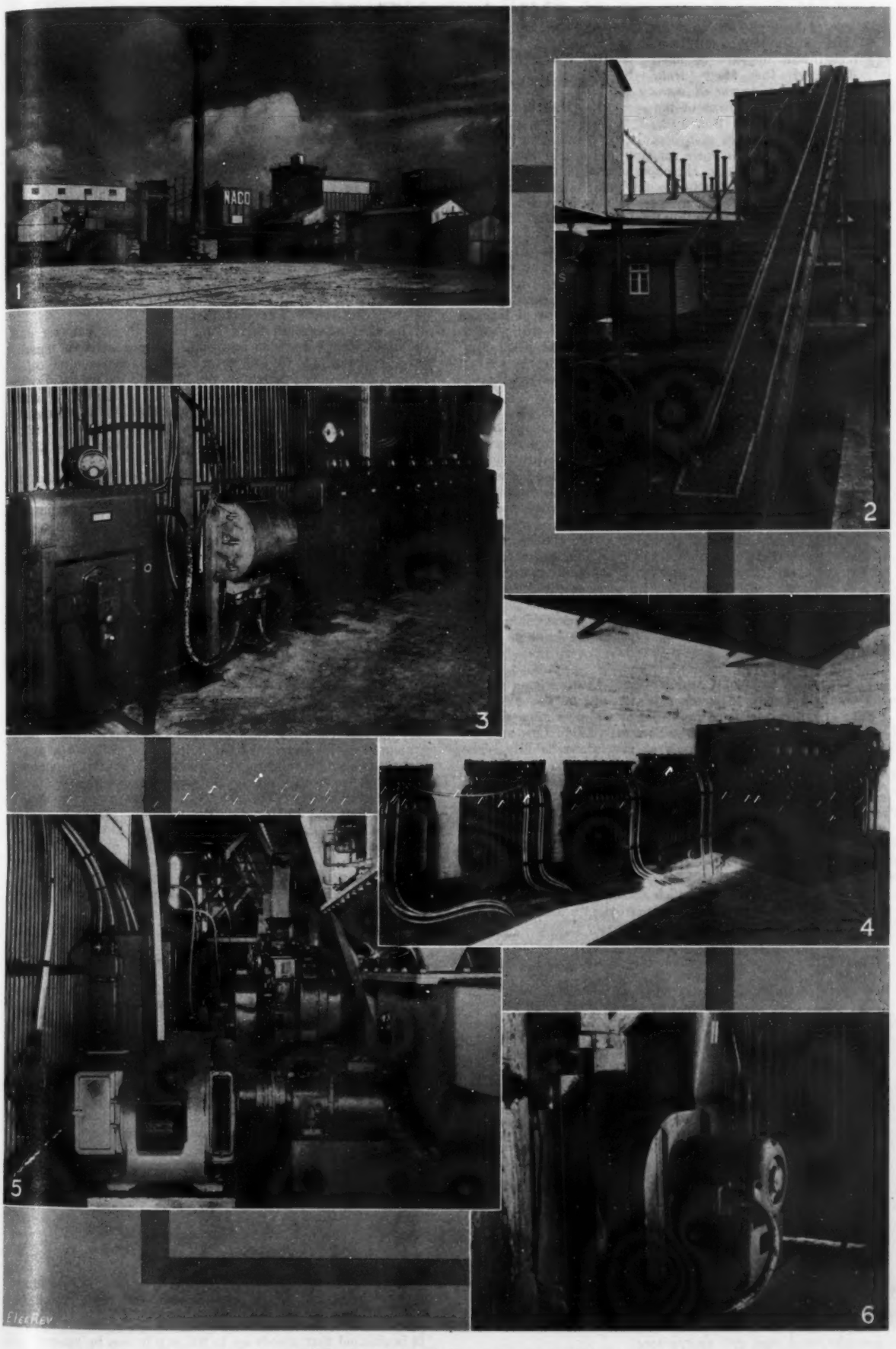
WHILE it is to be regretted that Dr. P. Kapitza will not be able to continue his researches at Cambridge University with intense magnetic fields, the arrangements proposed seem the best that could be devised to avoid undue interruption of his work (which is of more than national importance). The apparatus that will be transferred to Russia will not interfere with investigations in England into the effects of intense magnetic fields at low temperatures. The production of temperatures within one-thousandth of a degree of absolute zero is now possible with large electric magnets, which may make possible the direct study of the magnetic properties of atomic nuclei that is associated with the University, and more particularly with Lord Rutherford and Dr. Cockroft. An important difficulty occasioned by the change is the loss of contact with Dr. Kapitza's co-workers, but two of his assistants are to join him in Russia for a period.

Rectifiers for Railways

IT is now just over four years since we recorded the successful operating results obtained with the first mercury-arc rectifier to be put into heavy railway service in England. This was the 1,500-kW unit installed at the Hendon sub-station of the London Underground Railways. Although the comparatively low voltage of 630 did not permit the maximum efficiency to be obtained, the general performance was good enough for orders for an aggregate of 55,000 kW to be placed for this system, and Mr. A. L. Lunn, in his I.E.E. paper, left no doubt that the early promise has been maintained. Since then rectifiers have been put into commission elsewhere at 1,500 V, and shortly British-made units at 3,000 V will be in service in Poland. This should influence railway electrification in Great Britain, as the higher voltage, in addition to increasing efficiency, allows a greater spacing of sub stations on main lines.

The Oldham Explosions

THE explosions in the streets of Oldham last Friday, which resulted in the death of one person and injuries to thirteen others, has been tentatively attributed in a daily paper to the percolation of gas into an electric cable subway, where it was ignited. As the inquest has been adjourned, we can only say that, apart from the temporary disconnection of a length of main along the route of the explosion, the supply of electricity was uninterrupted. Mr. F. L. Ogden, the borough electrical engineer, informs us that examination showed his cables to be in perfect order. These are all of the paper-insulated lead-covered type, which replaced bitumen cables many years ago.



Oil from Coal. **(See next page)**

1. The new plant of the National Coke & Oil Co., Ltd., for extracting oil from coal. 2. A conveyor carrying "Naco" briquettes (a smokeless fuel) to the bunkers ready for delivery. A 6-h.p. Parkinson motor contained in the box at the top drives the conveyor. 3. Crompton "Klad" switchgear in the report house. 4. Scott-connected B.E.T. transformers (totalling 700 kVA) converting the 7,000-V 2-phase supply to 400 V three-phase. 5. 60-h.p. Crompton auto-synchronous motors driving coal pulverisers. 6. A "Klosd" motor driving a fan.

Oil from Coal

The electrical equipment at the National Coke & Oil Co.'s new plant at Tipton, Staffs

THE production of oil from coal now appears to have reached the stage from which it can be developed commercially. The new plant of the National Coke & Oil Co., Ltd., which is one of a chain of five projected stations, is the outcome of five and a half years research and development work at a cost of over £300,000. The experimental plant at Cannock has now been dismantled, and the new plant with a capacity of 300 tons per day of coal-oil mixture is now in production at Tipton, Staffs. The main contractors were the Horseley Bridge & Thomas Piggott, Ltd.

The raw materials are coal and creosote in the proportion of 93 per cent. coal and 7 per cent. creosote. The finished saleable products are: (1) A high-grade motor spirit, known as "Napet" (over 15 gal. per ton of coal processed); (2) a smokeless fuel in graded sizes of small, hard, ovoid blocks, known as "Naco" (about 15.6 cwt. per ton of coal); (3) a heavy oil, which is at present returned to the plant and employed in the process, but which could, in favourable market conditions, be partly converted to Diesel oil and sold at a profit.

The coal is received from trucks and passed through a screen on to a conveyor which carries it to bunkers. Thence it is distributed to feeders above electrically driven pulverisers which reduce it to a very fine dust, which is then intimately mixed with coal oil from the process and passed through slowly rotating retorts. These are heated by the combustion of gases which are a by-product of the distillation process; producer gas is used in starting up the retorts.

The volatile matter is drawn off from the retorts, passed through condensers, and treated in the refinery where the motor spirit is produced. The coke is taken from the lower end of the retort and passed through screens, the fines being carried to the briquetting plant, where, after being mixed with bitumen and steam heated, they are pressed into ovoid shape and taken on a wire conveyor to the bunkers ready for sale.

Dustproof and Reliable Plant

Two main factors determine the nature of the electrical plant: (1) The presence of quantities of coal dust, necessitating extensive use of closed and pipe-ventilated motors and air filters, and (2) the importance of absolute reliability. The process is a continuous one, and if the retorts should stop revolving while hot for more than a few minutes they might suffer serious damage.

The main supply, at 7.000 V, and a standby supply, at 2,750 V, are provided by the Midland Electric Corporation for Power Distribution. The supply is two-phase, 50 cycles, and is transformed to three-phase, 400 V, by Scott-connected B.E.T. transformers (700 kVA for the main supply and 100 kVA for the standby, which serves the retorts and the lighting only). Sixty yards of four-core p.i.l.c. steel-taped cable carries the current from the brick sub-station to the switchboard near the retorts.

The main distribution board, built up of Crompton "Klad" units, comprises the standby supply switch, a change-over switch, two main supply switches, and eight 200- and 400-A feeders. Change-over to the standby can be carried out in two minutes—well within the danger limit.

The largest drives are those to the pulverisers, retorts and briquetting plant. Four 60-h.p. pipe-ventilated motors, two of the auto-synchronous type and two slip-ring, drive "Atritor" pulverisers, three through "Texropes" and one direct-coupled. As satisfactory runs for the ventilating pipes could not be arranged "Visco" filters are to be fitted.

The Retort Drives

The steel retorts are 50 ft. long and 5 ft. in diameter and slightly inclined towards one end. They revolve at speeds varying, according to the nature of the charge and other factors, between one revolution per hour and 100 r.p.m. Power is provided by 15-h.p., 585-r.p.m. motors situated away from coal dust in a culvert beneath the retort house. These motors are direct-coupled to oil pumps which operate v.s.g. units installed near the retorts, the final drive being by friction, thus securing a flexible drive.

A 60-h.p. auto-synchronous motor drives the machines in the briquetting shop through shafts and belts. Most of the others drive the conveyor system and suction fans and pumps. The fifty motors installed (600 h.p. in all) are, with a few exceptions, of Crompton Parkinson manufacture, and extensive use is made of machines of the "Klosd" type, in view of the dusty atmosphere.

Materials are handled throughout either by electrically driven conveyors or, in the case of the pulverised coal, by suction fans and blowers. In consequence, the plant can be run by a small labour force. The refinery where the motor spirit is produced is the only part of the works where electric driving is not employed. Process steam is required, and it was found that the capital cost of steam plant was less.

The whole of the electrical plant was installed by the National Coke & Oil Co.'s own staff under the direction of Mr. G. Morris, the electrical engineer. Callender wire-armoured cables were used for lighting as well as for power instead of conduit, and in Mr. Morris's view wiring has been thereby more simply and quickly carried out than it would have been otherwise; for instance, two men wired twenty-five lights in four and a half days. Brass stuffing glands were used to protect dust-tight joints.

By employing three 60-h.p. Crompton auto-synchronous motors, two on the pulverisers and one on the briquetting plant, the power factor of the installation is kept in the neighbourhood of 0.95, at which the overall cost of energy is about 0.4d. per kWh.

"The Face of Britain"

A FEW months ago (March 8th, page 339) we made reference to a film which was being produced by the Gaumont-British concern for general showing in the cinemas of this country. Our interest in it arose from the facts that the Central Electricity Board had collaborated with the producers and that the film had a strong electrical "message" without being "propaganda" in the accepted meaning of the term.

Last week, through the good offices of Mr. Hugh Quigley, of the Central Board, we were present at a private showing of the film which has now been generally released.

In the first place it must be said that the production is excellent. The camera has been used with notable skill to produce some beautiful photography from many angles. We are first shown rural England as she was (and fortunately still is, in parts)—pleasant rural scenes and leisurely activity; pure air and fresh green fields and trees; and quiet unspoiled villages.

Then a map of Great Britain flashes on to the screen and six black patches—the coal areas—spread over it. There follows a sequence showing the dire results of the Industrial Revolution: devastated countryside and dismal, squalid towns—smoke, soot and grit everywhere.

All of a sudden a large insulator fills the screen and the crackling of an electric discharge is heard while arcs play about the surface. The age of electricity has arrived. We are shown "shots" of the Grampian Scheme, Ironbridge and Battersea, and the grid marching gracefully over the whole country. Regeneration is in sight and the first great efforts are depicted; handsome modern buildings of steel, glass and concrete and the banishment of smoke are vividly presented. By this means the significance of electrification is powerfully impressed upon the mind and the work of the Central Board is brought clearly before the public which it serves.

The film is to be in general circulation for about two months. After this it will be available to electricity supply undertakings for exhibition, at a reasonable fee, and the Electrical Development Association has been given a number of prospectuses for the information of its members.

If the film meets with a demand from those authorities the producers have it in mind to make further films of an electrical character. We can certainly recommend it as good popular matter with a considerable educational value.

The Railplane

We have recently received particulars of the Railplane system of transport, which consists of a stream-lined car suspended from bogies running on a single overhead rail, and propelled by air-screws driven by electric motors or oil engines. It is claimed that speeds up to 200 m.p.h. can be reached and maintained with economy. The track is a lattice box girder supported on steel trestles 80 ft. apart, along the bottom of which the mono-rail runs. The lattice contains the patrol way. Below the car is an auxiliary rail for controlling running. The cost of an electrified double track is estimated at £35,000 per mile, as against £60,000 for steam railways.

Reconstructing Distributors.

By D. P. Sayers, B.Sc., A.M.I.E.E.

Operations involved in the change-over from d.c. to a.c. in Northern Ireland

THE acquisition by the Electricity Board for Northern Ireland of the undertakings in its supply area involved considerable alterations to the mains network in each town, in addition to the change-over from d.c. to a.c. of the connected apparatus described in the ELECTRICAL REVIEW of October 25th and November 1st. The first step in deciding the arrangement of the final a.c. system was to mark on a plan of the existing layout all available information as to the disposition of the existing loads and potential loads, and position of all high-voltage lines available for a.c. tappings. After careful study of these plans in the office, an a.c. diagram was prepared showing proposed feeding points, size of distributors, and switching arrangements. This diagram was then used as a basis on which the physical layout was worked out by the district engineer on site.

The types of construction included:—

(a) Underground cables, usually employed for short distances in the immediate vicinity of the sub-station and through the main streets of one or two of the larger towns.

(b) The under-eaves system of surface wiring, used very extensively in nearly all built-up streets, which consists of single-core cables supported on porcelain cleats; the insulation of the cables has been specially produced for this class of work. The special advantages of the system are neatness, economy in servicing and absence of engineering difficulties inseparable from the construction of pole lines in narrow winding streets in built-up areas. The mains normally consist of two or four wires up to 0.1 sq. in. in section.

(c) In the country roads and outskirts of towns and villages pole lines of standard construction.

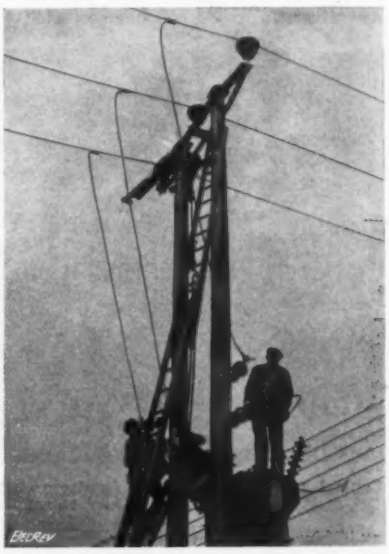
In deciding the physical arrangement of the a.c. layout the question arose as to how far the proposals ought to be influenced by the existing d.c. equipment. In many places the existing pole lines ran through gardens and back yards behind the houses; proper clearances and factors of safety had not been observed, and maintenance would be difficult. On the other hand, if these routes were scrapped and new a.c. distributors built along the fronts of the houses the new services would enter the premises from that side whilst the old services entered at the back.

Each case had to be considered on its merits; in most of the towns some kind of compromise was adopted between the existing routes and the ideal routes, after full consideration of the servicing question and the probable effect on wayleave negotiations.

Another problem was the advisability or otherwise of using old materials. In three towns where most of the existing distribution consisted of overhead lines supported on steel poles, the a.c. layout was arranged so that as many as possible of the steel poles in satisfactory condition could be used *in situ*. The majority of the existing wood poles were found on examination to be too light or not in good enough condition for further use, but a proportion of the best were worked in on service lines or other lightly coppered lines.

On completion of the final a.c. layout plans the detailed programmes were worked out, these being tied up to some extent with the change-over programmes. Owing to the extreme urgency of all the work special care was needed to secure the closest possible co-ordination between wayleave negotiations and the engineering work.

Detailed surveys of the pole-line routes were carried out and dimensioned sketches prepared by the district engineer to show the exact position of every pole and stay and wayover. These sketches were prepared in duplicate and copies were passed simultaneously to the way-leave department and the contractors, thereby informing both parties of the exact proposals in view and eliminating any possibility of discrepancies.

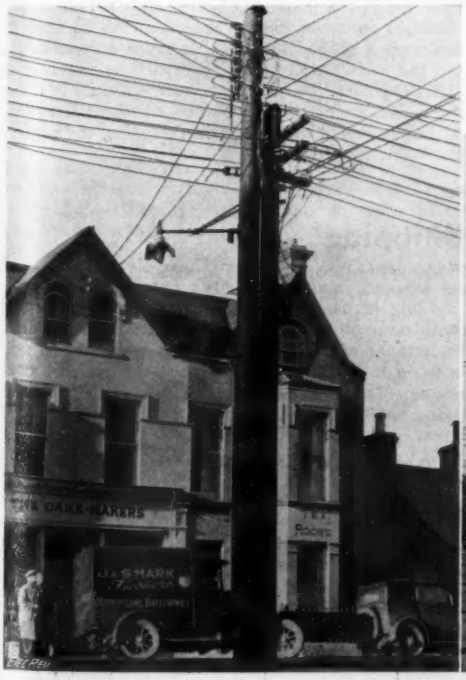


Work in progress on a 33-kV tapping to supersede the local d.c. generating station

For the surface wiring runs, large-scale diagrammatic tracings were prepared for each street or block of houses, each house being given a distinctive reference number and notes appended to show the exact nature and position of all equipment to be erected on each house. The number of premises on which the surface wiring was erected totalled more than 5,000 separate premises and covered thirty miles of distribution mains.

All the existing service wires were of 7/.036 or smaller section and in many cases went into the house through an upstairs window. They were then out of sight until they appeared at a meter board situated on the ground floor in the centre of the premises. It was therefore decided to reconstruct completely all services, to include new service wires of not less than 7/.064 (the Board's standard size), and to fit new meter boards equipped with the standard main cut-outs, meters, and consumers' main switches where

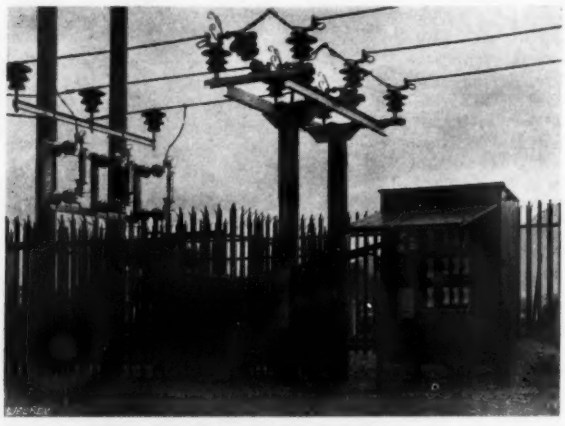
The old and the new: Two examples illustrating the difficult nature of the reconstruction work. The shape of the old poles in the right-hand picture should be noted and so should the original method of feeding the street lamp on the left



necessary. This decision ensured that cookers, &c., could be installed freely in the future without further alterations, but it entailed a great deal of work which was not envisaged at the outset.

The bulk of the work was involved in altering the internal wiring to connect the consumer's installation to the new meter board which was erected wherever possible in the hall or other accessible position within 6 ft. of the point of entry of the lead-in wire.

During the later stages of the change-over additional wires had to be run out temporarily on the existing pole lines wherever only two wires existed and three-phase circuits were required. P.b.j. or v.i.r. insulated wire was suspended on the poles either by insulators of the "Wonpeace" type screwed into the pole or by "D" irons wired on to the cross-arms. This arrangement was also used extensively during reconstruction wherever supplies had to be continuously



Typical arrangement of transformer and distribution kiosk in one of the 33-kV sub-stations

maintained for power consumers, and particularly on the steel pole lines where very little work could be carried out safely with any bare wires alive. The usual procedure in such cases was to string up four insulated wires temporarily, to which all the services were transferred while the old wires were being removed and the new wires erected.

Much of the reconstruction work had to be carried out under difficult and dangerous conditions, as service to all consumers had to be restored each night. In only a few instances could the service be interrupted during the day except by special arrangement owing to the number of motors and other appliances in use. Consequently the work had, as far as possible, to be carried out with the lines alive, and during the major reconstruction of any particular section the adjacent sections were invariably alive.

A code of safety regulations was rigidly enforced. Particular stress was placed on every linesman having a proper equipment of safety belt, rubber gloves and boots and test lamps. In addition written "permit-to-work" certificates were issued whenever the line was made dead and returned by the foreman or engineer-in-charge before the line was again made alive.

These precautions helped to ensure a certain standard of care and "safety first" throughout the work; nevertheless, accidents did occur, but in every case the cause could be traced to the man himself having neglected to carry out the rules given in the code.

Special attention had to be paid to meeting Post Office requirements as regards clearances and protection, particularly in the larger towns. During the detailed survey of the a.c. layout, accurate particulars were taken of all Post Office plant affected. A schedule of the proposals was prepared usually after discussion with Post Office engineers who were most helpful throughout in surmounting difficulties which do not arise in the straightforward construction of new overhead lines. The existing live d.c. wires frequently restricted any movement of the Post Office wires and also the erection of the new a.c. wires, and ways and means had to be devised by close co-operation between the undertakers and the Post Office engineers.

Responsibility for Earthing

Prior to the change-over the earthing of lead-covered or conduit installations and of motor frames was exceptional. After the change-over a definite point was made of securely earthing all the new a.c. motors and any existing conduit or lead sheathing. It is, however, questionable how far the undertakers' liability really extends under such circumstances, as it is the consumer's responsibility to see that his installation is properly bonded and earthed. In the larger towns there was a public water supply with service plugs in most of the houses, to which the meter cases and main switches could be conveniently earthed.

The real difficulty occurred in the smaller towns which had no water supply laid on to every house. In the early stages the earth wires were connected to one or more galvanised earth stakes 3 ft. by 1¼ in., driven into the garden outside the house, but tests showed this method to be entirely unreliable, the effective resistance often running into hundreds of ohms.

After various investigations the method was adopted of running a main earth wire on each block of houses. This wire was normally 0.06 sq. in. bare copper strained along the front or (preferably) back walls on insulators, and the individual service earth wires were connected by sweated joints. The main earth wire was connected to earth at each end either by a substantial bank of earth pipes, or more usually by some kind of connection to a water main in the street. The figure of two ohms was regarded as the maximum safe value; this figure was attained in the majority of cases after perseverance, but the difficulties in some places were such as to lead to further consideration of leakage trips as more economical.

Throughout the work weekly progress reports were rendered by each district engineer. These reports were essential in order to keep under record the rate of progress on all essential aspects of the work, but care had to be used in designing the reports to reduce the work involved.

Lloyd's Register of Shipping

THE annual report of this Society's operations during the year 1934-35 records the completion of the Diesel-electric tug, *Framfield*, for the Thames Steam Tug & Lighterage Co., Ltd., the entire propelling equipment for which was built and tested under the inspection of the Society's surveyors.

Similarly, at the request of the owners, two other Diesel-electric equipments have been specially surveyed during construction for the *Talisman* and *Bellubera*. The former is a new vessel built by Messrs. A. & J. Inglis, Ltd., and engined by the English Electric Co., Ltd., and now on regular duty on the Clyde in connection with the passenger services of the London & North Eastern Railway. This is believed to be the highest-powered (1,300 s.h.p.) Diesel-electric paddle boat in existence, and is notable in that the motor is mounted direct on the paddle shaft, running at 50 r.p.m. without intermediate gearing. The double-ended passenger ferry boat *Bellubera*, owned by an Australian company, is being converted from steam to Diesel-electric drive. The British Thomson-Houston Co., Ltd., are the main contractors and the equipment includes four Harland & Wolff Diesel engines and four propeller motors, each rated at 615 s.h.p. Further, the Diesel-electric research vessel, *Artabro*, built for exploration purposes in the upper reaches of the Amazon, has been completed by the Union Naval de Levante, S.A., Valencia, to the Society's classification.

In the Society's register book there are now forty-two turbo-electric vessels of 480,236 gross tons, an increase of 35,688 tons on the previous year, and fifty-seven Diesel-electric vessels of 121,261 gross tons, an increase of 2,408 tons.

Electric welding in merchant shipbuilding has been largely concerned with its application to bulkheads, tunnels, and deck flats, and an amount of experience is being gained which will be valuable when a greater expansion of its use in ship construction occurs. Three ships in which the employment of electric welding has been wholly adopted have been completed during the year. They are a tanker of 1,560 tons gross, and a vessel of 2,130 tons gross for service on the Great Lakes and Gulf of St. Lawrence, both constructed by Messrs. Swan Hunter & Wigham Richardson, Ltd., Newcastle-on-Tyne; and a motor yacht of 91 tons by Messrs. J. Samuel White & Co.

The list of electrodes tested by the surveyors to Lloyd's Register and approved by the Committee as complying with the requirements of the rules now contains the names of 86 electrodes, of which 44 have complied with the special requirements for use in parts of primary importance in the structure of a vessel. Dr. J. Montgomerie, the Society's chief ship surveyor, has visited the principal British and Continental shipbuilding centres to discuss electrodes, the methods of welding, and the design of structural arrangements to avoid distortion.

The Society continues to give the closest attention to the testing and inspection of fabricated engineering structures, and to undertake the survey of pressure vessels and machinery in which welding forms an important feature.

Precision Frequency Control. By J. C. Orkney, B.Sc., A.M.I.E.E.

A new use for the grid-controlled mercury vapour relay in a.c. testing

IN many test rooms and laboratories, and even in heavier testing, the synchronisation of 50-cycle a.c. mains has not proved to be quite the blessing that may have been expected. The frequency merely averages 50 cycles over periods of, say, twenty-four hours, and value is not absolute at all times. A deviation of a small fraction of one per cent. seriously upsets tests results in many commercial instances as well as in precision testing.

My experiences have been with small machine testing and with precision testing by means of bridge methods and the a.c. potentiometer, involving the use of a very sharply tuned (resonant) vibration galvanometer, but the final solution of the problem of obtaining really constant frequency is so simple and easily applied that it may perhaps appeal also to those engaged in quite general testing. There seems no reason to suppose that the fundamental idea is limited to the relatively small powers generally called for in precision testing, though my personal experience is limited to the synchronisation of a 20-kW supply only.

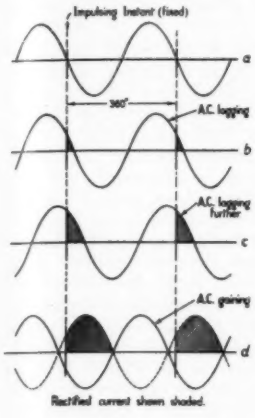


Fig. 1

Some form of fundamental reference frequency is required, but this may take almost any convenient form, such as an oscillatory circuit or electrically maintained fork, since the power demand is only of the order of a few milliwatts. Reference frequency equipment of this type can readily be so shielded from atmospheric and other disturbances as to limit the frequency drift to any desired order of accuracy. Claims of accuracy of one part per million over long periods of time have been made, but even an inexpensive steel fork without any special precautions is capable of giving an accuracy of one part per ten thousand or better over long periods of time, and this is quite good enough for most requirements. The present description indicates the use of an electrically maintained fork merely for the sake of simplicity; the output from a simple oscillating triode has also been used very successfully to the extent of permitting "tuning" of the motor-alternator speed to suit the vibration galvanometer, by means of a variable condenser!

Characteristics of the Relay

The link between the reference frequency and the motor-alternator speed is the grid-controlled mercury vapour relay which is similar to an ordinary radio valve (triode) in having a hot cathode, a grid and an anode, but which, instead of being completely evacuated, contains mercury vapour at a very low pressure owing to the presence of a drop of mercury in the bulb. The mercury vapour provides infinitely more free electrons than a hot cathode alone, so that the current handled by the relay is very much greater than that with a similar simple triode and the voltage drop between anode and cathode is only of the order of 15 to 20 V. The heated cathode continues to be essential in order to provide the initial free electrons which restart the arc.

The presence of the mercury vapour also greatly changes the action of the control grid. Assuming the anode to be made positive by connection, say, to a battery, the grid can prevent any current passing by being kept sufficiently negative (generally of the order of 20 to 30 V). If the grid negative potential is reduced to a certain critical value, or given a positive impulse, current flow starts at once and is limited only by the resistance of the complete anode circuit, the grid having lost all control as soon as the arc starts. The arc can be stopped only by reducing the anode voltage below 15.

The title "relay" is quite justified in that the expenditure of a few microwatts of energy on the grid will release or "trigger" a large flow of energy in the anode circuit, yet the grid has no control over the amount of the anode current. If the anode is supplied with a.c. instead of d.c., current will naturally cease at the end of the positive half-wave, giving the grid an opportunity to regain control every cycle while the anode is negative. By arranging for positive impulsing of the grid at a suitable instant during each cycle the amount of (rectified) current passed can be controlled, not by the amount of the grid potential but by the phase position of the impulse. The action, in this respect, is identical with that of a grid controlled mercury-arc power rectifier. It is this fragile glass "toy" which has been put into service for directly controlling the speed of quite large motors with ease and precision.

It is not a new idea to synchronise a small motor-alternator set with a reference source such as a fork, but in the past it has been necessary to supply the motor from a large battery to ensure steady voltage input and to load the alternator with a constant resistance or "swamp" load to render negligible all variations in the test load. Also, considerable currents were carried by the fork contacts and by split slip-rings on the motor shaft. In contrast with this, the relay method permits synchronisation with almost any type of reference frequency, while the motor can be supplied from ordinary fluctuating d.c. mains, is entirely self-synchronising and is indifferent to large changes of load. Full load could be switched on and off a 1.5-kW 3,000-r.p.m. alternator set that was quite unsuited to the work with only a momentary self-correcting surge in speed.

Motor-alternator Supply Preferable

The sole remaining difficulty is that of variation of d.c. excitation of the alternator should it not be provided with its own exciter. If no battery is available a bank of barretters and a differential resistance can be used as indicated in fig. 2. An inverted rotary (d.c. to a.c.) can be synchronised by this method, but the output voltage will still reflect the d.c. mains variations and changes in the power factor of the load have too much effect on speed, so that the motor-alternator undoubtedly remains the better source of supply for this purpose.

The fundamental idea is that the anode of the relay is supplied with its alternating voltage directly from the alternator whose frequency is to be stabilised, while the grid is impulsed from the reference frequency source, these two being nominally of the same periodicity. The result is most easily followed if we consider the alternator to be running slightly too slow so that it lags behind the reference frequency and to take as starting point the condition at which the grid receives its positive impulse just at the moment when the anode voltage has died from a positive value down to zero (fig. 1 (a)). No current passes under this condition. As the wave applied to the anode progressively lags, however, increasing amounts of current will be released by the grid impulses (fig. 1 (b) and (c)). Let this relay-controlled current then be used as auxiliary field excitation for the driving motor, acting in opposition to the existing shunt field, and it is obvious that the more the machine lags behind the reference frequency the more will the resultant motor field be weakened, causing the motor to speed up and keep in step with only a few degrees of phase shift possible.

The first attempt with a small set was encouragingly successful. It was only after trying various circuits and circuit constants and different machines (up to 20-kVA, three-phase, in one case) that experience began to be gained in the peculiarities of the method, and they are very much less troublesome than might have been expected. None of the motors used was in any way special.

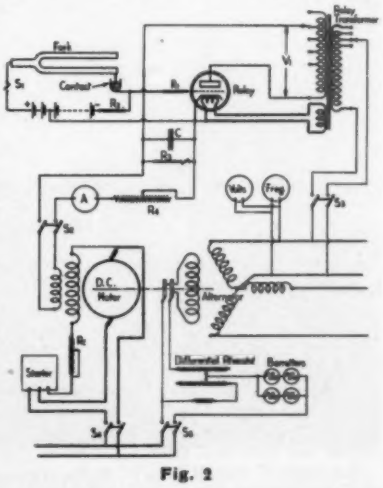


Fig. 2

Basic Layout

Fig. 2 shows the complete basic layout. For simplicity, the motor has been shown with an auxiliary field winding distinct from the ordinary shunt, but this is not essential. The motor-alternator set is started up and adjusted in the ordinary way, the relay transformer being switched on and the fork started. With the speed set about five per cent. slow the closing of switches S_1 and S_2 causes the set to pull quickly into step with the fork. The ammeter (or milliammeter) A is the most instructive and useful instrument apart from the frequency meter, and the best value for its indication is soon found by experiment; it is generally quite a small current, and is controlled by

alteration of the motor field resistance R_4. As the motor field warms up R_3 requires to be gradually reduced, but it is not a critical control and is easily judged by watching the correction current in ammeter A. If the motor runs overspeed the relay control can do nothing.

Resistance R_1 may be a radio type of the order of 0.1 megohm; its function is merely to limit any tendency to grid current (acting as an anode) during the positive impulse, while R_2, of the same type and value, prevents short-circuiting of the battery when the positive impulsing circuit is closed by the fork contact, shown here as a mercury cup and needle. If any form of a.c. is used as the reference frequency the positive end of the battery and the fork are discarded and a voltage of, say, 30 or 40 r.m.s. is introduced *via* a radio-type transformer whose secondary replaces R_2. The usual small reservoir condenser C is quite uncritical. R_4 is useful in by-passing a few milliamperes, sufficient to cause the relay bulb to glow and die as the fork and supply pass in and out of synchronism before S_2 is closed. Synchronising by means of S_1 instead of S_2 is the more "artistic" method, in that it controls such large effects with such tiny effort.

Full-wave Operation

The d.c. potentials for the grid are shown battery supplied, and radio grid bias batteries were actually used, but this would naturally be a rectified supply in making up a self-contained unit. A series of experiments was also made with two relays arranged for full-wave working. This was found impracticable with a 50-cycle fork owing to the impossibility of maintaining exact 180 deg. phase displacement of the two contacts. It is possible that a double-frequency fork might overcome this trouble. With an alternating reference wave supplied to the two grids by a "push-pull" intervalve transformer, the relays shared the load successfully, but there seemed to be more tendency to speed surges. Since the single relay arranged for half-wave rectification was entirely satisfactory and very lightly loaded, there seemed to be no advantage in adding the complication of full-wave operation.

Consideration was also given to the control of overspeed running down to synchronism, but, as expected, the attempt has not been successful with this simple method. Reverting to the wave diagrams, imagine the machine to be overtaking the reference frequency and assume the use of a separate relay using the opposite half-wave (shown dotted in fig. 1 (d)) correctly connected to assist the normal shunt winding on overspeed. As soon as the anode wave overtakes the impulsing instant the impulse allows full current to flow for the entire half-wave and continued overtaking reduces the amount of current flow—a very different condition from the former ideally gradual increase from zero. The result of many attempts to extend the same method for overspeed conditions was violent surging of the motor speed. The method in all its simplicity is, therefore, apparently limited to correcting the speed upwards and fails entirely if the normal shunt field weakens to the extent of producing overspeed. This is not a serious drawback in practice; indeed, it need only be considered because of the initial heating of the motor field at the beginning of a run.

The anode voltage V_1 and the ballast, or limiting, resistance R_4 are the most important independent variables in the circuit and have optimum values best found by experience with the particular machines in use. A little consideration will show that these have a large control over the steadiness of running and the ease in pulling in to synchronism. Generally speaking, quite high values for these two items seem desirable.

The employment of an ordinary commercial motor without the additional field winding is a matter of interest in more ways than one. Since the relay circuit is entirely isolated electrically, it is quite in order to apply the correction current directly to the existing field winding, merely taking care that its direction is correctly in opposition, but two new effects now enter which repay a little consideration. First, the correction current will not all go through the field winding; it has the alternative route through the field rheostat R_3 and the mains (including the motor armature), which must be relatively unattractive compared with the field winding proper. This is most easily done by using a large value of R_3 and a corresponding increase in the voltage applied to the field circuit.

Many standard laboratory test sets are built for a low speed of 25 cycles or less and run at 50 cycles on a very weak field. Such machines will behave perfectly with no extra field resistance, for if even half the correction current can be made to go through the field the control will be effective. Only a low value of correcting current is required (in small sets a few milliamperes is adequate), and the steadiest running is obtained with the least practicable correction. The other point to be noticed in using the field winding for both duties is that the voltage applied to the anode of the relay will now have the d.c. potential drop across the winding added to the a.c. from the transformer, and unless the a.c. peak value were definitely greater than the d.c. potential the anode would never be negative and the grid could never regain control after the first impulse. This feature is actually helpful rather than otherwise, in that it provides a greater phase angle over which impulsing can be effective, so much so that it might be desirable to add a deliberate d.c. potential in certain cases to extend the angle of control. Under this condition the direction of power flow through the relay transformer may actually be reversed (inverted grid-controlled rectifier) in that the excess current in the field is being extracted by the relay and handed back to the a.c. line.

Simple to Use

Those who, in ordinary commercial testing, have experienced the annoyance, lack of accuracy and waste of time occasioned by frequency drift and fluctuation are well advised to try this very simple master control, even though the reference frequency may be nothing better than a home-made radio valve oscillator. Those who, in precision testing, have tried other methods of synchronising will find this method a delight to use. On ordinary fluctuating d.c. mains and with widely varying loads on the alternator one finds the check test of the tuned vibration galvanometer consistently correct, hour after hour, with no attention to or supervision of the alternator at all.

The experimental work in connection with this development has all been carried out in the recently established laboratories of the Electrical Engineering Department, Robert Gordon's Technical Colleges, Aberdeen. Acknowledgments are due to two recent graduates, Messrs. A. M. Hardie and P. D. Burr, who carried out a great part of the experimental work and verification testing.

Power Supply on the Rand

(From our South African Correspondent)

AN indication of the expansion of the gold mining industry of the Witwatersrand since January, 1933, can be gathered from the activities of the Victoria Falls and Transvaal Power Co., Ltd., which supplies the electrical requirements for the mines, excluding the Randfontein, East Rand Proprietary and the New Kleinfontein Gold Mining Companies. The maximum sustained hourly electric and compressed air load has increased from 325,000 kW in December, 1933, to 389,500 kW in June, 1935, while the average daily output has increased from 5,798,000 to 6,967,000 kWh.

The first of the 33,000-kW turbo-alternators at Klip power station is expected to be in service about the end of this year, but, to meet immediate demands, extensions of the existing five stations have been carried out. In addition to the three 33,000-kW sets originally proposed for the Klip station two similar turbo-alternators have been ordered.

At the Vereeniging power station, which now has 140,000 kW installed, an additional boiler for dealing with 15,000 kW has been installed. At the Brakpan power station a further boiler has been erected, raising the capacity of the station by 5,000 kW to 42,000 kW. The local compressed air demand of the Brakpan mines is equivalent to 9,000 kW, and one of the existing 1,500 kW compressors is being replaced by a 3,000-kW unit. At the Rosherville power station one of the original 3,000-kW air compressors installed in 1910 will be replaced by one of increased output in the near future. At the Witbank power station of the Electricity Supply Commission, which is operated by the Victoria Falls Company (to whose system at Brakpan it is connected through two 132-kV overhead lines), four additional boilers have been erected to increase the output of the station to the full capacity of the five 20,000-kW turbo-alternators.

A 45,000-kVA coupling transformer has been installed at the Brakpan station arranged for on-load tap-changing. A 20,000-kVA rotary condenser has also been installed there to improve the voltage regulation of the eastern section of the company's system. A third 7,000-kW electrically driven air compressor has been completed at the Canada Dam compressing station, raising its capacity to 21,000 kW, for serving the Florida area. The demand on the interconnected compressed air system of the Central Rand now reaches 66,000 kW; the compressed air reticulation system is the only one of its kind in the world,

and its plant capacity is now 80,000 kW, of which 35,000 kW is in the electrically driven stations at Robinson Central and Canada Dam.

Last year an 8,500-kW supply by a 20-kV cable from the Rosherville power station was given to the Johannesburg undertaking during the municipal peak hours. A second 8,500-kW circuit is now available.

In 1932 the South-Eastern Rand, supplied from the Brakpan system, was connected directly with the Vereeniging power station through two 80-kV lines. Last September the Western Rand was also directly connected with Vereeniging by an 80-kV line. An 80-kV line to supply the mining areas in the Klerksdorp district is in course of erection. Two additional 80-kV lines are to be erected, one of which will interconnect the Vereeniging power station directly with the Simmer Pan station at Germiston and the other will link into the Rand system from the new Klip station.

Five 20,000-kVA rotary condensers are in operation at Klakfontein station (two) on the South-East Rand, Robinson central distribution station, the new Princess distribution station on the Western Rand, and at Brakpan power station. Three similar machines are now on order for Simmer Pan and Rosherville power stations and for another point.

The company's records show that as many as 200 lightning storms of varying severity may be experienced on its system during a single season. This has made it necessary to duplicate and in some cases quadruplicate the feeders and interconnectors to important consumers. Accurate information of fault occurrences and the performance of the plant, switchgear and protective devices is obtained by cinematograph cameras installed at various points to photograph instruments provided on special boards for the purpose. The cameras are automatically operated by the occurrence of faults, and over 400 film records have been obtained and analysed.

The reliability of the company's system has been improved by the provision of automatic reclosing gear for a number of the more important supply switches of the undertaking. The company's records show that in more than 85 per cent. (in the more modern lines often 100 per cent.) of the overhead-line trips due to lightning, the affected line is immediately serviceable. This has enabled special devices to be used for switching a tripped line automatically back into service in a few seconds.

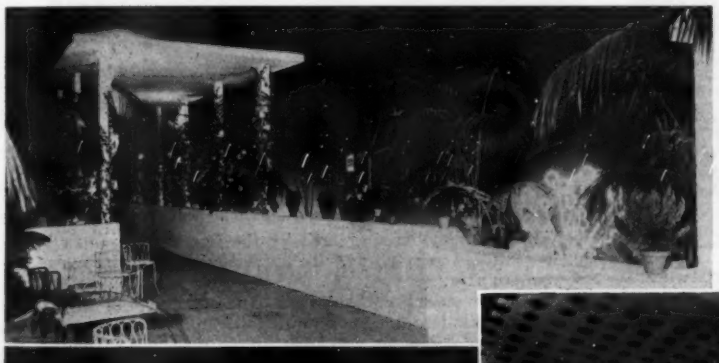
On the company's 40-kV system and the 20-kV networks in the Brakpan areas, Petersen arc-suppressing coils have been installed experimentally to ascertain their efficacy under the severe lightning conditions of the Rand.

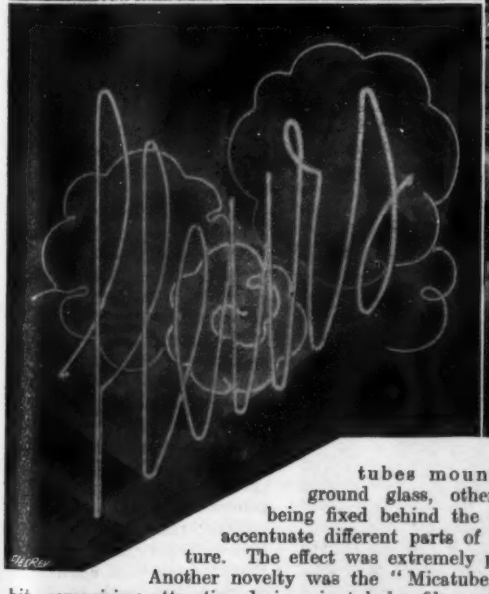
Artistic French Lighting

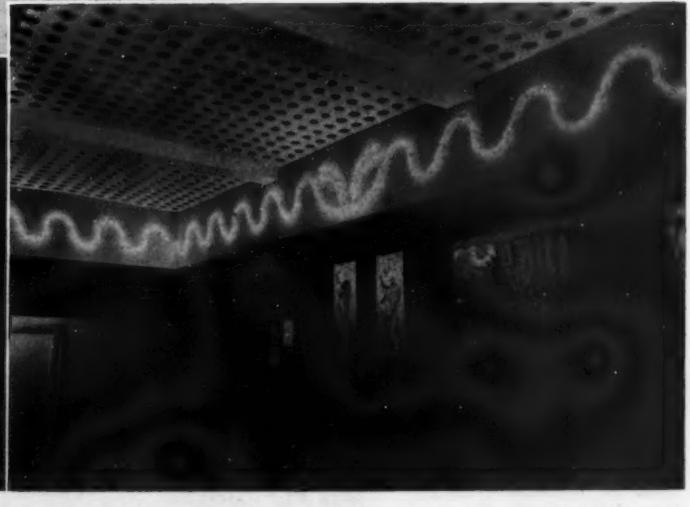
Novel effects seen at this year's Salon de la Lumière

ALTHOUGH it is devoted more to the applications of lighting than to the technical aspect of the subject, the annual Paris Salon de la Lumière gives a good idea of the latest developments in French lighting practice. This year's salon was, perhaps, the most complete and interesting yet seen, the exhibits occupying three floors of the new offices of the Compagnie Parisienne de Distribution d'Electricité.

Among the latest types of lighting on view was a collection of "luminous posters," for which a competition was arranged. These included a striking picture designed in gaseous colour-light tubes mounted on ground glass, other tubes being fixed behind the glass to accentuate different parts of the picture. The effect was extremely pleasing.







Top: Terrace lighting by Claude Paz et Silva
Bottom left: Luminous poster design (Stalla).
Bottom right: "Micatube" lighting effects

Another novelty was the "Micatube," exhibit, comprising attractive designs in tubular filament lamps. Much of the exhibition was the result of collaboration between the lighting engineer and the decorator, a notable example being the suggested terrace lighting by Claude Paz & Silva. The scheme consisted mainly of illumination from projectors hidden in the shrubbery. General lighting was obtained by means of decorative designs in neon tubes combined with mercury-vapour tubes to give a warm white light, the effect being remarkably fine.

Illuminated picture frames came in for a share of attention, several different systems being on view. The simplest of these and also one of the most interesting was the "Arlux," which is intended for photographs or reproductions on paper or thin card. It consists of a curved metal sheet with a lamp fixed at each end to reflect light over the surface. It is so arranged that no direct light can reach the eye of the observer.

The lighting of bookshelves by Pierre Chareau was an advance on previous practice in this direction, illuminated indication letters on the frames of the shelves throwing light on to the spines of the books and thus facilitating the tracing of any particular volume.

Several good examples of shop window lighting were to be seen. Ocel displayed their electrical appliances, while a suggested lighting scheme for a florist's window was shown.

Applications of photo-electric cells were demonstrated by the Alsthom Company, including models of train gates so controlled, as well as of safety devices for machine tools.

The "Luminifere" exhibited by Monsieur Niepce consists of an opaque background into which are set pieces of thick glass of any desired shape. In a box behind the frame thus formed are placed a series of electric lamps so arranged that they give an even lighting. The light coming through the thick projecting glass, gives an effect similar to that of incandescent tubes, and it is claimed that the design can be seen more easily from a distance than in the case of light tubes.

Trolley-bus Development

New models seen at the Commercial Motor Show, Olympia

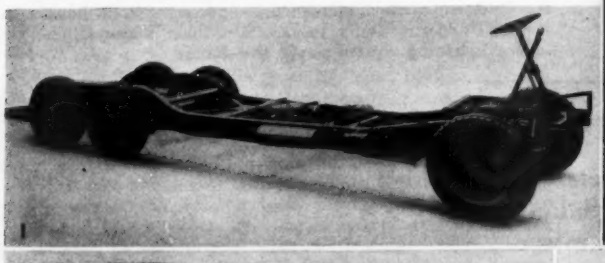
THE present tendency to scrap tramways both in this country and abroad is opening up a very profitable field for trolley-bus manufacturers. Several new and improved vehicles appear at the Commercial Motor Transport Exhibition now being held at Olympia, London, and we were particularly interested to make the acquaintance of new trolley-bus chassis made by Crossley Motors, Ltd., who are newcomers to this market, and by the Associated Equipment Co., Ltd., in conjunction with the English Electric Co., Ltd. All-metal bodywork construction has been receiving considerable attention and nowadays nearly all transport undertakings using trolley-buses specify regenerative control. As the vehicles are almost always used to replace trams a high seating capacity is generally demanded.

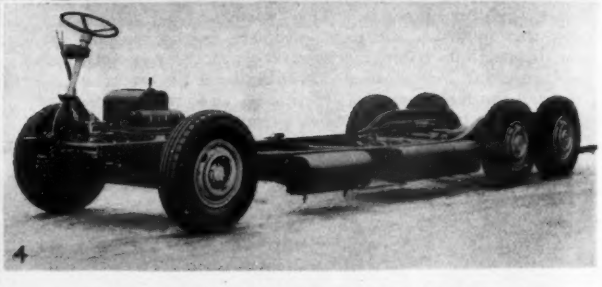
The Crossley chassis mentioned is a development of the company's rigid six-wheeler and has a 18 ft. 7-in. wheelbase, approximately 6 ft. 6-in. tracks, and an overall length of 29 ft. 9 in. It is of robust construction and incorporates substantial cross-bracing members. The 82-h.p. Metrovick compound-wound motor mounted centrally in the frame is designed for regenerative control down to about 12 m.p.h., below which speed rheostatic braking connections are automatically switched in.

The contactor gear of the electro-mechanical type is fitted with magnetic blow-outs and renewable arc chutes, the function coils being energised from the trolley supply. The contactor panels are fixed in the driver's cab in insulated covers. A plate-type foot pedal operates the master controller, which is of the scissors type with twelve positions. The resistances are supported by brackets from the chassis frame and mounted on dry-spot insulators. Automatic circuit-breakers are used and an over-voltage relay is incorporated, a similar relay being used to prevent the establishment of rheostatic braking connections until the re generation current falls below the predetermined amount.

For an extra charge provision is made for emergency operation by two 24-V batteries in series, a protective device making it impossible for the main circuit to be connected up when the batteries are in operation. Other equipment includes two radio interference suppressor coils and a lightning arrestor of the multi-path type. C.A.V.-Bosch 24-V lighting is provided with a single-shaft motor-generator.

The new A.E.C.-English Electric trolley-bus chassis is claimed to be the lightest six-wheeled British model built. Completely wired and with full electrical equipment, it weighs only 4 tons 9 cwt. 2 qrs. and with an 18 ft. 7-in. wheelbase can accommodate a 74-seater body. The design follows in principle that of the 252 A.E.C. trolley-buses ordered by the London Passenger Transport Board as a part of its conversion scheme in the metropolitan area.





1. New Crossley chassis. 2. One of the 38 Leyland-Metrovick trolley-buses with a Brush all-metal body for the Woolwich Bexleyheath service inaugurated last Sunday. 3. Leyland-C.E.C. two-door model. 4. The new A.E.C.-E.E.C. lightweight chassis

The electrical equipment includes an 80-h.p. compound-wound traction motor with direct-driven low-voltage generator, carried on "Floatex" flexible rubber suspension from a tubular sub-frame. The mounting of the motor centrally behind the "ground-clearance" area permits a low floor height and a short drive to the rear axles. A foot-operated controller of the standard drum-type provides a wide range of speed control and is mechanically interlocked with a hand-operated reverser in the same framework. Line and resistance contactors, shunt-field contactors, over-voltage and overload relays and tripping relay are enclosed in cases mounted through insulators on the side frame of the chassis.

Simplified wiring is ensured by housing the shunt-field resistance with the shunt-field contactors, since all connections between the contactors and resistance are made internally. The line contactors are operated by overload relays which are automatically reset by returning the controller to "off."

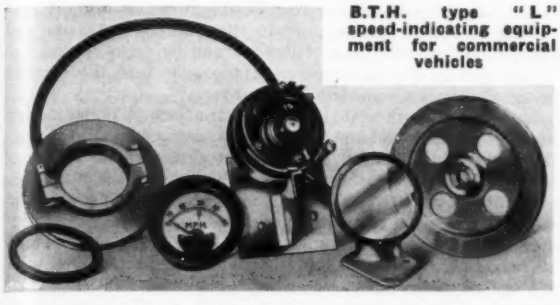
Regenerative braking controls the vehicles down to the speed at which the motor generates at less than line voltage; rheostatic braking is then brought into operation. Patents have been applied for in connection with the braking relay system which ensures continuity of braking by establishing the connections to the rheostat without opening the circuit. An inno-

One of the latest Ransomes, Sims four-wheeled 62-seater vehicles being unloaded at Capetown

vation is the utilisation of the lighting batteries for manœuvring the bus in emergency.

A special feature of the equipment is the method of mounting the low-voltage lighting generator on the main motor. The generator is built on a spider fitted to an extension of the motor shaft, and the frame is bolted to the main motor end-shield. The generator can be dismantled, therefore, without disturbing the main motor. The speedometer, too, is recessed into the lighting generator so as to take up the minimum space. To guard against any possible electrical leakage a special multiple testing plug has been fitted.

A six-wheel trolley-bus chassis and a completed vehicle with a 56-seater double-deck body as used at Bournemouth and a 32-seater single-deck four-wheel model for Wolverhampton are the principal exhibits on the Sunbeam Motor Company's stand. Both these models, which are driven respectively by 80- and 65-h.p. B.T.H. motors, are already well known. Regenerative



B.T.H. type "L" speed-indicating equipment for commercial vehicles

control, automatic rheostatic braking, and radio interference suppressors are among the up-to-date equipment, and outstanding features are the accessibility of all electrical gear and the metallic screening of all power wiring. The vehicles are smooth and silent in operation and have already proved themselves reliable and economical. Bournemouth will soon have 103 Sunbeam-B.T.H. trolley-buses, while Wolverhampton recently placed its sixth repeat order for 4- and 6-wheel models.

A complete three-axle Leyland-G.E.C. vehicle of the "low-floor" type and also a two-axle chassis, are to be seen on the General Electric Co.'s stand. In the former two 40-h.p. motors for series-parallel control are mounted on either side of the frame, the drive being taken through Spicer couplings of ample size for the heavy torque that has to be transmitted. Seating accommodation for sixty-three passengers is provided and there are two staircases with the entrance at the rear and the exit at the front. The two-axle model has a single 80-h.p. motor centrally mounted and arranged for series control with field regulation. For the London Transport Board's new trolley-bus service put into operation last week-end from Woolwich to Bexleyheath, the Brush Electrical Engineering Co., Ltd., has built thirty-eight all-metal bodies for mounting on Leyland-Metrovick chassis. One of these is on view. Karrier Motors, Ltd., are exhibiting a six-wheel chassis with an 80-h.p. Metrovick motor for Newcastle and a complete 60-seater double-deck vehicle (93-h.p. motor) for Huddersfield. The placing of a large-size 75-h.p. motor in front of the six-wheel, 60-seater Guy chassis permits lower flooring, greater accessibility, better cooling and freedom from dust and mud thrown up by the wheels. Automatic regenerative control is provided, and the 13-step drum controller gives very smooth acceleration.

A patent system of combined regenerative and rheostatic control is employed on a four-wheeled 62-seater trolley-bus made by Messrs. Ransomes, Sims & Jefferies, Ltd., for Capetown. It has a Weymann all-metal body and is driven by a 80-b.h.p. motor, with Allen West control gear. A similar chassis for Ipswich is also displayed, as well as a 2-ton battery-driven industrial truck. Incidentally, we were surprised not to find many other "electrics" since on account of their low operating costs they are ideal for short-distance transport services.

On one of the new Leeds petrol-buses is to be seen an ingenious safety device invented by Mr. W. Vane Morland, general manager of the City's Transport Department, and Mr. T. H. Parkinson, one of the engineers at the Donisthorpe Street Depôt. Two switches controlling a motor operating the brakes can be used by the passengers or conductor in emergency in the same way as the railway communication cord.

Most of the new developments in components and accessories were commented on in our review of the recent Motor Show, but one or two additional items caught our attention. Simms Motor Units, Ltd., has introduced new 4¼-in. and 5¼-in. diameter dynamos, which are designed for a large output and have voltage regulators and ventilating fans.

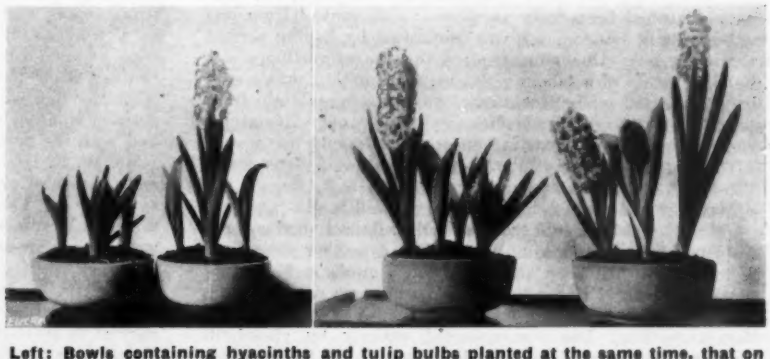
A feature of the same company's new starter, which is supplied in 5- or 6-in. diam. sizes for 12 or 24 V, is that the actuating pinion is moved into mesh by means of a solenoid. By mounting the reflector on to the bezel the bakelite lampholder of the new Simms non-glare headlamp can be removed immediately. The two contact pins are independently sprung. Included among the British Thomson-Houston Co.'s comprehensive display are magnetos, coil-ignition sets, speed indicators, flexible couplings, "Fabroil" timing gears and lamps.

For the lubrication of trolley-buses, Tecalemit, Ltd., is introducing the "HP112" high-pressure drum pump and the "LP10" gear oil dispenser operated by an electric motor-driven compressor. The Equipment & Engineeering Co., Ltd., now has a "Magnaflux" crack detector for mass-production work.

Indoor Bulb Culture. By D. B. Williamson

SOIL heating on a domestic scale makes an interesting winter experiment. Little electricity is required and the prospect of having hyacinths and tulips in bloom a few weeks before their normal date is a pleasing one for the grower and his possibly sceptical household.

Towards the end of last January four hyacinth and four tulip bulbs were bought, and two of each were planted in fibre in two identical bowls on the same day. Both bowls were subjected to the usual three weeks in a dark cupboard to allow the roots to become established, no artificial heat being applied during this period. Afterwards the bowls were placed on an inside window ledge well in the daylight. One bowl was heated by a resistance connected across the mains, absorbing about 2.5 W. This was arranged below the bowl and the heat percolated more or less uniformly through the bottom. The temperature of the fibre at the bottom was kept at 60° F. by a small glass-sealed vacuum thermostat.



Left: Bowls containing hyacinths and tulip bulbs planted at the same time, that on the right being electrically heated. Right: The same bowls two weeks later, the tulips in the heated one being now in bloom

After four weeks the hyacinths in the heated bowl had broken bud, and the heat was cut off to prolong their flowering period. A week later they were in full bloom, and in another fortnight both sets of hyacinths were flowering. The difference in development was then shown up by the tulips, which were in bloom in the heated bowl, although the buds were not yet showing in the unheated one. The heating produced no difference in the quality of the blooms, so that the only gain was in obtaining the flowers earlier and for a longer period.

The tests were made during February and March and consequently the heated bowl was "racing the spring." There can be no doubt that a repeat experiment in November and December would show an even more marked result.

The energy consumption at 2.5 W for four weeks amounted to 1.7 kWh, or less if the thermostatic control were taken into account. This very small power suggests the possibility of developing the "electric flower bowl" as a new low-consumption domestic appliance. Meantime the idea and experiment may appeal to many others who find pleasure in watching plants grow and having early flowers.

The scope of this idea is not limited to bulb growing. In the warmer weather a thermostat set for 80 deg. F. was used and a small orange tree grown from seed thrived in the steady warmth. Tropical flowers and plants may well prove as interesting as tropical fish. Cacti are generally accustomed to arid and warm conditions, and in our climate they tend to develop very slowly. There can be little doubt that a heated cacti bowl would induce a much faster and more interesting growth, and would probably bring certain species into flower.

Meetings and Discussions

Boiler Furnace Construction: Torsion and Thrust Meters: Diesel Railway Traction

Boiler Furnace Design and Operation

AT a meeting of the London Local Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION last week, Mr. B. Samuels, of Messrs. Babcock & Wilcox, Ltd., lectured on development in boiler furnace design and operation. He said that there were those who believed that the future method of firing very large boilers in super-power stations would be to maintain the ash in a liquid form and tap it out, perhaps from the centre of the rear of the furnace. In the latest form of slag tap furnace a screen made of special refractory material was interposed to maintain the necessary temperature.

There was a very high rate of heat liberation, but there was no "bird-nesting." That was a very considerable advance on previous work, because until something of that nature had been done there was a limit to the type of coal that could be used, inasmuch as it had to have a fluid temperature of 2,500 deg. F., which would rule out the whole of the coals in this country. Obviously, with the variety of coals available in this country the aim should be elasticity to deal with practically every coal, and the latest arrangement of slag tap furnace enabled a temperature of 2,900 deg. F. to be reached. At the same time, the slag tap furnace could only be used really effectively with boilers working under base-load conditions.

It was often said that the introduction of pulverised fuel had been responsible for an improvement in the design of mechanical stokers, but he disagreed. What it had done for the designer was to enable him to use a large furnace. But the introduction of the tall furnace for pulverised fuel had certain detrimental results, one of which was that stoker ratings were pushed up to an extent which increased maintenance. Boiler ratings were also being pushed further and further, so that they were getting to the end of their tether in providing a stoker capable of performing the high duty which the boiler involved.

The increase in the combustion rate called for fresh thought about secondary air. It had been decided that the proper place to introduce the secondary air was at the point where combustion had been thoroughly established, namely, about half-way up the very tall furnace. But extended experience in a wider field showed that there were coals which did not take very kindly to the admission of secondary air in that position. Lower admission by 6 ft. or 7 ft. was much more effective, and the actual air pressure necessary was usually not more than 3 or 4 in. The author expressed the opinion that the introduction of secondary air at the rear of the furnace had been a great advantage for certain coals which were not easy to light. Among the other advantages were the shortening of the flame and making it the same height at the rear of the furnace; also, it permitted of earlier ignition, while the bulk of the grits was thrown off from the rear of the fire and blown over the rear of the stoker, this re-injection of the grits into the furnace being obviously a considerable advantage.

Lantern slides indicated how by variations of boiler design the heat release could be considerably increased without involving undue maintenance of the refractories, and the view was expressed that with the proper application of secondary air and suitable water-cooled walls it might be possible to go up to two or three times the present combustion ratings.

One effect of higher ratings would be that the stoker could be run faster, so that it would not be in the fire so long, with an advantageous effect upon maintenance. Moreover, an increase of the stoker rating from 30 lb. to 60 lb. per sq. ft. would have but a negligible effect on furnace temperature.

The user of coal for steam-raising purposes should have some consideration given to his requirements; the collieries seemed to have a whim of their own in this matter. They liked to wash their coal down to 3 or 4 per cent. of ash to oblige one type of customer who was sufficiently strongly organised to be able to demand it, while other customers had to take what was available whether it was suitable for their particular purposes or not.

Finally, Mr. Samuels referred to the effect of wetting coal. He said that the time factor was very important and, although it might not be known yet exactly what happened when coal was wetted, there was little doubt that it led to a more open fuel bed and better air distribution.

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Mercury Rectifiers for Electric Railways

THE paper in which Mr. A. L. Lunn describes the mercury rectifier sub-stations now in use on the Underground railway system of the L.P.T.B. (to which reference was made last week) was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 7th. Mr. F. Pick (L.P.T.B.), opening the discussion, remarked that while the selection of rectifiers had involved an element of risk, the choice had not been regretted. In Germany they had been more ambitious, with control from one centre, but in London risk was minimised by having several control centres. One advantage of the use of rectifiers was the clearing up of a labour problem, for minding rotary sub-stations was not really decent employment. To maintain train speeds under increasing traffic conditions new sub-stations were needed between existing ones, and it would not always be possible to add rotary sub-stations in that way. The use of rectifiers had not involved any great extra cost, though the sub-stations had perhaps been a little too well built.

Mr. C. E. Fairburn said that the L.M.S. Railway had covered the same ground as the author, but on a smaller scale, and its experience had been similar to Mr. Lunn's. Multi-core pilot cable control might be expensive in some cases; on the L.M.S. system a one-pair method had been successful. The Manchester-Bury line was operated entirely by glass-bulb rectifiers; the average bulb life had been 11,500 hours, while some had lasted for 17,000 hours. All repairs had been small and quickly done, while no water cooling was needed. The Liverpool-Southport line sub-stations had been equally satisfactory. British-made rectifiers would soon be operating in Poland, where the climatic conditions were very severe.

Mr. G. Henderson stated that soon 200,000 kW of rectifiers would be in service on railways, which showed that that type of plant had come to stay. Rectifiers did not need sub-station buildings so elaborate as the author's seemed to be. Metal anodes were just as reliable as graphite ones, provided the right sort of metal were used. All railways did not have such good loading conditions as the Underground. To switch in resistance at low load was a waste of power and not really necessary. The use of an excitation transformer would prevent the drop between no load and full load exceeding 40 V. Preheating was not really necessary, for rectifiers had operated at a room temperature of zero. The time and power stated by the author to be needed for tank bake-out seemed excessive. Dr. A. H. Railing commented on the Underground organisation's foresight and courage in embarking upon a rectifier installation of such a magnitude. If that attitude of giving manufacturers a chance to demonstrate what they could do were more evident industry as a whole would gain much. Progress would be made with voltage control and with other details, but from the rectifier itself not much more could be expected so far as reliability and efficiency were concerned. Automatic leak indication was not needed because no leakage had yet materialised with the present type of seal.

Mr. W. E. Highfield said that it should be remembered that rectifiers were makers of harmonics, whereas rotaries acted as dampers. Therefore performance would differ according to whether faults occurred on the a.c. or d.c. side. If anything were to be regretted it would be the loss of the energy stored in rotary plant for smoothing out fault conditions.

Mr. F. P. Whitaker thought that there was not much chance of 600-V rectifiers being materially reduced in size. They showed to greatest advantage on low load factors. Smoothing should be such that no interchange of harmonics would take place between the several generating stations feeding into any one network.

Mr. E. Gallizia considered the insensitiveness of rectifiers to disturbances on the h.v. a.c. side to be one important reason why they should be employed, even on 500-V three-wire systems. He confirmed the author's finding that d.c. ripple made no difference to the commutation of traction motors. There was something to be said for d.c. ignition, since it avoided mechanical oscillation of the ignition gear.

Mr. J. E. Calverley asked whether the author knew how far the rectifier tank potential really wandered from the full value to earth. The need for smoothing circuits was debatable; as there was no record of complaint the conclusion was that smoothing was not necessary. The use of openings in

the ignition gear had been discredited for some time. Mr. J. C. Read said that the double-star method of connecting transformers would be most used in future. In steel tanks there was nothing that really needed to be renewed. Therefore maintenance should be reduced to such small proportions that no other class of rectifying apparatus would be able to emulate it.

Dr. C. C. Garrard remarked that better load factor might be discounted by lower power factor. Better voltage regulation resulted from the use of a larger source of supply. The more a rectifier was made to work the better it seemed to regulate itself, which was a characteristic not shared by any other type of apparatus. Possible derating of generators consequent upon low power factor might be minimised by connecting equal numbers of rectifiers in delta. It was wise to install smoothing circuits in order to avoid any possibility of complaint, but it was to be hoped that unnecessary complications would not be introduced.

Dr. E. H. Rayner asked what sort of instruments had been used to measure the working efficiency with the accuracy implied in the paper. The author seemed to have obtained greater accuracy than available instruments were capable of. Mr. A. M. Browne contended that the use of 12-phase connections instead of 6-phase would reduce the need for smoothing circuits. Rectifiers of 2,000-kW capacity were being made to operate in parallel with rotaries and to have the same overload capacity. The use of glass bulbs in place of steel tanks would avoid many troubles.

Mr. J. W. Rissik wanted to know the relative cost per kW of glass bulbs and steel tank rectifiers. Mr. P. H. Taylor said that rectifiers and d.c. armatures were both producers of harmonics. Rectifiers were the greater offenders simply because they had fewer effective phases than d.c. armatures. Mr. O. Wood considered the most striking feature to be the adequate roomy sub-stations provided to hold the equipment, which, on the Underground system, was unusual. The stated efficiency of the equipment was rather lower than he would have expected.

Mr. A. L. Lunn, in reply, said that the two-wire system of control had the disadvantage of time, which they could not afford to lose on the Underground Railways. On one occasion when the Hendon line was shut down all the six substations had recommenced operation within one minute. He would be glad to see the last of the rotary convertors on his system. He had decided to provide smoothing circuits because he considered it to be the duty of a public body to do whatever it could to avoid causing disturbance. Service and reliability were two of the most important factors. His preference was for rectifiers, though he would not make any one system carry more than its fair share of them.

* * *

Measuring the Twists of Shafts

IN the paper by Mr. T. R. Thomas which was read before the INSTITUTE OF MARINE ENGINEERS in London on November 12th, instruments are described for measuring the torque and thrust of ships' rotating shafts. The thrustmeter measures the deflection of a number of springs interposed between two frames attached to the flanges of a convenient shaft coupling. Torsionmeters measure the elastic twist of a short length of the shaft itself caused by the application of torque. Both optical and electrical indicating apparatus have been employed.

In the original experiments of Denny and Johnstone, the index marks took the form of electric contacts, so arranged that a circuit was completed when the moving index was in the correct position, and the completion of the circuit was indicated by a click in a telephone receiver. Later, magnets were used passing over coils in which an e.m.f. was induced. The coils were connected so that one opposed the other, and the position of correct adjustment was then indicated by the absence of any sound in the telephone receiver. The electrical indication had the advantage that the distance between the indicating points could be made as great as the length of the shafting would allow, and so a comparatively large angle of twist was available for measurement.

The averaging type of apparatus always employs electrical indicators, either by measuring a resistance which varies with the relative movements of the shaft indicating sleeve and stump, or by matching in an external instrument a change which is caused by the movement. The electrical connections are made through slip rings mounted on the sleeve. Measurement of resistance is used in the Denny-Edgecumbe electrical torsionmeter. The relative movement to be measured is magnified by mechanical gearing, the final shaft of the gearing carrying an arm which moves a sliding contact over a resistance strip arranged in a circular path so as to form a rheostat. A specially calibrated galvanometer is connected in circuit with this rheostat, the calibration being arranged so that the position of the galvanometer needle corresponds with the position of the sliding contact.

The Ford instrument is probably the best known of the "matching" type of indicator. The relative movement of the sleeve and stump moves a small iron armature which is arranged in an air gap in the circuit of a small transformer. The induced e.m.f. in the secondary windings of the transformer when an intermittent current flows in the primary will then depend on the position of the armature. A transformer identical with that on the torsionmeter is mounted in the receiving instrument, with the armature movable by a micrometer screw. The secondaries of the transformers are connected together and to a galvanometer so that the induced e.m.f.'s are in opposition. By turning the micrometer screw until the galvanometer indicates no current the armature of the "receiving" transformer is brought into the same position as that of the transformer on the torsionmeter, and the movement is then read off from the position of the micrometer screw. By closing the circuit only momentarily once each revolution when the transformer is in a predetermined position, spot readings may be obtained, and by altering the position of the momentary contact the cyclic fluctuation may be explored.

A very interesting "matching" type of indicator is used in the Maihak torsionmeter. The ends of a fine piano wire are attached to arms, one on the sleeve and one on the stump, so that the tension in the wire is varied by any relative movement of the arms. An electro-magnet is arranged to pluck the wire when current is passed through its coils, and the wire vibrates between the poles of the magnet. The arrangement then acts as an electro-magnetic telephone transmitter, and the note sounded by the vibrating wire can be heard in a telephone receiver connected in the circuit. This note depends on the tension in the wire and hence on the torque in the shaft.

The receiving instrument is provided with a similar wire and magnet, and the connections are arranged so that both wires can be sounded and both notes are heard together in the earphones. A micrometer screw varies the tension of the wire in the receiving instrument, so that it can be tuned until the two notes are the same. The movement of the screw necessary to effect this then represents the change in length of the wire in the torsionmeter.

Averaging instruments such as already described are all dependent for their accuracy either on the calibration of the electrical apparatus or on the degree of similarity of the transmitting and receiving elements. These are features which are not necessarily permanent, and if faults occur there is nothing to indicate their presence. In spot reading optical instruments the intermediate electrical link is usually eliminated and this makes the calibration one which depends on linear dimensions only.

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Diesel Railway Traction

THE application of the Diesel engine to railway traction on passenger lines and in shunting yards is the subject of a paper by Mr. C. E. Fairburn which was read before the INSTITUTE OF TRANSPORT in London on November 11th. The author states that electrified suburban services demand heavy horse power, often as much as 15 h.p. per ton at starting to give the necessary acceleration, but the diversity factor on an extensive system is such that all the trains can be operated by a relatively small power plant and distribution system, whereas with Diesel units each train has to be engined for the largest demand; furthermore, the engine and transmission take up space and add weight to the train, and this weight has itself to be accelerated, increasing the h.p. required as compared with a corresponding straight electric train. The extra plant required, engine, transmission, housing accommodation for the engine and drive, and larger motors is such that there would not appear to be any field for Diesel traction on heavy suburban services, but it is found that the lighter the traffic the smaller is the advantage of electric traction owing to the lesser spread of its equipment costs.

The light construction of coaches can be applied to electric traction in just the same way as it is applied to the Diesel unit. For powers below 200 h.p. it is generally admitted that mechanical transmission is technically satisfactory, while for powers above 300 h.p. it is believed that electric transmission only is satisfactory. Electric drive provides better and simpler control; makes it easier to drive on several axles; and gives better characteristics on lines with gradients.

On the whole, where possible it would seem that the best arrangement is the power bogie, which permits the use of a reasonable size of engine and offers good facilities for maintenance. The engine and transmission required for a shunting locomotive are quite different in characteristics from those required for the railcar. Lightness is not of importance, and a lower speed engine will have a longer life and require less maintenance. Noise, heating, smell and vibration are not of such importance.

Smaller types of shunting locomotives have been built for railway service with all kinds of transmission. For the type weighing about 50 tons and with a maximum tractive effort of about 30,000 to 33,000 lb. manufacturers in all countries use electric transmission and most manufacturers who advocate mechanical transmission for railcars are equally convinced that, for shunting, electric transmission is to be preferred, having in mind the knowledge and experience up to date. Development may change this view, but at present the consensus of opinion is strongly in favour of electric transmission for shunting locomotives.

Dealing with the locomotive in its three main components of body and chassis, Diesel engine, and transmission system, the author describes the various arrangements adopted in various countries for shunting locomotives.

* * *

Thermal-electric Power Stations

IN his presidential address to the BELFAST ASSOCIATION OF ENGINEERS on November 13th Mr. H. R. Ayton describes the thermal-electric principle as applied to industrial plant, whereby electricity generators are used as reducing valves to lower the pressure of the steam between the boilers and the factory process machinery or heating system, thus producing electricity cheaply as an intermediate product. The author has installed a number of plants of this description. He gives an account of what is being done in America and Canada, and suggests that the principle could be applied with advantage to certain industrial districts, such as Belfast, as distinct from individual works, with equal economy.

Thermal-electric stations would have an efficiency of 60 per cent. at least, and while Mr. Ayton does not advocate their substitution for condensing power stations, he does not doubt that in a number of industrial areas (working in conjunction with condensing stations) they would have a better overall efficiency and prove to be a large source of income. Electricity would be generated as a by-product, the main consideration being the sale of steam, for the author declares that unless electricity authorities can provide cheap steam as well as cheap electricity they cannot compete with industrial thermal plant.

A plant with a capacity of 1,000 kW whose exhaust steam is used for heating is estimated to be capable of supplying electricity at an all-in cost of 0.14d. per kWh when operating for eight hours per day and at 0.082d. per kWh for a 24-hour day. Cheap steam would attract new industries and expert supervision would increase efficiency; stand-by boilers and losses would be reduced, as well as maintenance and attendance costs; fuel and ash handling would be more convenient, and there would be less smoke and dirt nuisance.

In America 161 cities have underground steam mains, providing service in much the same way as gas and water. In 1930 twenty-two companies supplied 20,000 million lb. of steam and $90 million was invested in steam heating plant.

The paper contains details of the methods employed in American and Canadian cities for laying distribution pipes underground, together with costs and distribution losses. In New York there are sixty-five miles of steam mains, the largest being 24 in. in diameter, and the longest 4.5 miles. The pressure is 165 lb., and the hourly consumption 7,250,000 lb., while 15,300 lb. of steam is delivered to consumers for each gross ton (2,000 lb.) of coal burned. About 65 per cent. of the steam is used for heating and process work, and the balance for cooking, power, and industrial purposes. The six steam stations are interlinked with the electricity generating stations, which supply steam from stand-by boilers at off-peak times.

Mr. Ayton was told that electricity companies do not encourage electric heating because power and light provide a better return. For instance, 300 kW (1,024,500 B.th.u.) at ¼d. per kWh equals 8s. 4d., whereas 1,000 lb. of steam (1,000,000 B.th.u.) can be sold for from 2s. 6d. to 4s. 2d. at a good profit. The author contends that if sold for heating purposes electricity provides less heat than the amount of steam required to generate it, which he considers to be absurd both from the sales and engineering points of view.

* * *

A Coal Grinding Installation

THE resistance to grinding of coal is dealt with in the paper by Dr. H. Heywood which was read before the INSTITUTE OF FUEL in London on November 13th. The objects of this method of disintegrating coals, which could then be used as a standard to compare the relative efficiencies of industrial crushers and pulverisers; and also to investigate simplified methods of determining relative resistance to grinding which could be used in connection with routine tests on coals.

The most efficient method of disintegration was found to be the compression test on cubes of coal; crushing by impact of a falling weight and between crushing-rolls had approximately equal efficiency under certain conditions, but, in general, the efficiency of these processes decreased as the energy applied to the crushing process was increased. The resistance to grinding is measured by the energy in foot-pounds required to produce 1 sq. ft. of new surface, and has been determined for six different types of coal, two anthracites, shale and pyrites. Hardness measurements were made on the coals by means of the scratch test and by means of an abrasion test. The relative hardness determined by these two methods was approximately the same for most coals, but cannel was exceptionally tough.

Unless unwarrantable assumptions are made, specific surface calculations are too complicated for industrial and routine testing, and sufficient accuracy for most purposes would be obtained by taking as a measure of the fineness the percentage of the product passing a specified sieve. The results of all the tests are compared directly by using in each case the value for Barnsley soft coal as a standard.

The Department of Scientific and Industrial Research made a grant which has enabled this investigation to be continued, while the Sir John Cass Technical Institute and the Polytechnic, Regent Street, provided laboratory facilities.

* * *

Municipal Transport Problems

AN indication of recent progress made in municipal passenger transport problems and the nature of desirable developments were given in a paper submitted to a conference at the Commercial Motor Show last Friday by Mr. R. Stuart Pilcher, general manager of the Manchester Corporation Transport Department and chairman of a Special Committee of the MUNICIPAL TRAMWAYS AND TRANSPORT ASSOCIATION.

At June 30th last the Association had in operation 4,718 petrol-buses, 1,707 Diesel buses and 897 trolley-buses, as compared with 5,206 petrol, 389 Diesel and 565 trolley-buses at September 30th, 1933. As these vehicles are used almost exclusively for short-stage services, manufacturers are urged to give special attention to such things as brake heating and efficiency and accessibility of components.

It is unlikely and undesirable that there will ever be any standardisation of body design and construction among municipal operators, but the Society of Motor Manufacturers and Traders is making an effort to standardise some of the main dimensions of chassis construction, such as the length from rear dash to rear axle, distance from rear axle to front of rear platform, width of frame, spacing and dimensions of outrigger brackets, sweep of chassis front end, driver's cab dimensions, offset of engine, and length of rear platform.

It is stated in the paper that in general, municipal managers will always press for the greatest number of seats possible in the space available, and it is now suggested, in view of the Ministry of Transport Regulations and of an examination of statistics for the past two years, that operators should be in a position to select the maximum seating capacities which they require for each size of vehicle. During the past two years there has been a tendency to eliminate certain seating capacities and concentrate on others. With regard to trolley-buses, single-deckers are losing favour, the number in service having declined from 279 to 273. Among the double-deckers the most outstanding increase is one from 2 to 110 for 64-seaters, though all other classifications show advances as follows:—48-seaters, 36 (23); 56-seaters, 133 (70); 58-seaters, 81 (13); 60-seaters, 136 (100); others, 128 (78).

At a recent meeting of the Managers' Section of the Association the view was again expressed that a specification for

bus lighting was needed. It is believed that manufacturers, in the absence of specific requirements, give too little attention to voltage drop and install cables of insufficient size. Opinions are divided as to the relative merits of 12- and 24-V systems, but standardisation in any one fleet is desirable. There appears to be a preference for all switches to be grouped under the driver's control. On trolley-buses the modern tendency is to install low-voltage lighting, largely because this is insisted upon by the Ministry of Transport when all-metal bodies are used, to avoid danger from shock. The high-voltage system is, however, considered by some authorities to be less troublesome and perfectly safe.

The only means of obtaining a solution to the fog-penetrating problem is to investigate fundamentals. Methods adopted at Manchester which have done much to assist in maintaining services include white lines on kerbs, fog lamps, specially adapted pilot vans and tricycles, oil lamps and white coats, improved street lighting and the sectionalising of traffic arrangements.

A recommendation for a standard layout of drivers' controls is contained in the Joint Memorandum on Motor Omnibus Design and Maintenance issued last March as a result of the 1931 and 1933 Olympia Conferences. New operators of trolley-buses will be able to adopt the suggested standard for controls from the outset, and this should contribute materially to a reduction in accidents.

* * *

Transformers in Collieries

IN his presidential address to the ASSOCIATION OF MINING ELECTRICAL ENGINEERS (London Branch) Mr. A. F. W. Richards considered the choice of transformers for underground working from the user's point of view. In many particulars he regarded B.S.S. No. 355/1929 as out of date. Replies to a questionnaire from upwards of fifty collieries had provided information towards the compilation of a new standard.

Forty-eight collieries employed twenty-one no-load transformation ratios and seven primary voltages between 2,000 and 3,300 and nine secondary voltages between 440 and 650. None had adopted the standard 400 V, which would thus appear to be too low for colliery requirements. The majority used the standard ∓ 2½ and 5 per cent. taps. Allowing for only 6 per cent. taps, all the above ratios could have been embodied by employing three primary and three secondary voltages. Links would nearly always be preferable to tap switches for underground working.

Fourteen sizes of transformers were installed, seven having outputs recommended by B.S.S. No. 355 (out of nine between 10 and 300 kVA). Ignoring capacities below 35 kVA and above 200 kVA, three sizes would meet almost all requirements if loadings ± 10 per cent. normal rating were accepted. As transformers were rarely operated in banks underground and generally fed independent circuits the characteristics of existing units need not be considered. Impedance was generally from 3½ to 5 per cent.

Thirty-eight out of forty-nine replies called for delta/star connections, ten star/star and one star/delta. Mining Regulation No. 126B required the bringing out of the neutral on the secondary side, even if not used for service purposes. The B.S.S. recommended earthing the neutral point by a strap or link to an insulated stud external to the tank and housed in a separate box. Buxton certificates had been granted to several manufacturers for flameproof tanks up to 5 kVA single-phase or 3 kVA three-phase (but not higher), and a new clause to make this clear should be included in the B.S.S.

Out of thirty-six replies regarding dimensions, fifteen required 100-kVA transformers less than 44 in. high, six less than 35 in. wide, and seven less than 72 in. long—these figures being the B.S.S. values. Requirements had sometimes been met by making five- or even eight-unit three-phase transformers.

Nearly all transformers were oil-immersed, naturally cooled. Standard ratings (B.S.S. No. 171) were suitable where the temperature of the surrounding air did not exceed 104 deg. F. and allowed a maximum rise (by thermometer in top oil) of 90 deg. F., giving an ultimate temperature of 194 deg. F. There was a preference for horizontal cable entries, but many desired a universal type of box suitable for cables rising from floor level or coming in at the top or at the sides of the tank in vertical or horizontal positions. Flameproofness was essential.

Rollers were preferred to skids, but standardisation to suit pit tramlines seemed impracticable as there were fifty-seven different gauges in this country. Thermometers were not thought necessary, though a pocket was regarded as an advantage. An oil gauge of flush pattern was generally considered a desirable fitting.

Most replies called for a drain valve, although one of the largest supply companies insists on having no openings at the bottom of a tank. Conservators and breathers are rarely fitted; fine coal dust is likely to be sucked in through the latter.

* * *

Electrolytic Condensers

A PAPER by Mr. W. R. Bloxsidge which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on November 12th attempts to deal with a subject upon which, at present, very little published information is available. The principle of the unidirectional properties of aluminium electrodes in certain electrolytes is considered critically, the various processes of manufacture being enlarged upon technically, the reasons being given for each. The aqueous type in a cylindrical can, which forms the cathode, has an anode that is self-supporting and is fixed in an insulating bush. The condenser requires to be mounted vertically, and has various disadvantages owing to the free electrolyte. It can be broken down with impunity, as the dielectric reforms as soon as the over-voltage is reduced.

The absolute purity of all materials used in manufacture is of paramount importance. Elaborate precautions are taken to prevent the inclusion of dust, unwanted metals, and other impurities, and all operations are conducted in aluminium vessels cleansed with purest distilled water. None of the materials is touched by hand.

The dielectric consists partly of an infinitesimally thin film of a mixture of the oxide and hydroxide of aluminium, formed on the anode, which is made of foil of 99.8 per cent. aluminium content, by an electrical process. The foil is formed at a voltage depending upon the working voltage of the condenser for which it is intended. The formed foil is cut into lengths, with connection tabs folded out and corners rounded, and passes to the winding machine. The length required for a given capacitance is found in the first instance by experiment, and varies with the formation voltage.

The electrolyte consists of a specially prepared solution of ammonium borate held in a body consisting of a "fatty" organic compound "paste." There may be more than one independent anode in an assembly, and these can be designed for different working voltages if required. A heating process causes the paste to flow into intimate contact with the electrodes and has an important influence upon the capacitance and inherent resistance of the condensers. Ageing, after heating, is carried out by connecting the condensers to a d.c. supply, the voltage of which is gradually increased until the maximum voltage for which the condensers are intended is reached. A large current passes at the commencement of the process, and this gradually decreases to 0.1 mA per μF capacitance.

* * *

Illumination and Physiology

In a paper on "Visual Perceptions under Modern Conditions," read before the ILLUMINATING ENGINEERING SOCIETY on November 12th Dr. R. J. Lythgoe stressed the point that the eye is a living structure and that simple optical reasoning may be invalid when applied to it. The eye differs from many physical instruments in being very particular about surrounding conditions. It can function over a wide range of illuminations, from about 0.00001 to 10,000 ft.-candles, but in order to do so it demands that the ratios of brightnesses in the field of vision shall not be too great. Outstanding work has been done on the effects of illumination in industrial processes, and it has been established that even in occupations apparently calling for only the crudest visual perception, the performance is very materially speeded up by the provision of increased illumination, showing that poor light retarded movement. It was a sound principle that there should not be a great difference of brightness between the task and the surrounding field of vision, extremes of contrast being subjectively uncomfortable. The general increase in the standards of artificial illumination was in keeping with the more generous economic outlook of to-day, and minimum recommendations were constantly being revised. The real limit to the level of artificial illumination must be economic and technical. True skill in this, as in all things, was making a little go a long way.

* * *

Small Motors

The annual joint meeting of the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS and the INSTITUTION OF ENGINEERS-IN-CHARGE took place in London on November 13th. Mr. H. J. Eley delivered a lecture, illustrated with lantern slides and demonstrations, on fractional h.p. motors in relation to modern domestic and industrial development. Reference was made to the economic aspects, and the relative merits of various types of small machines were considered technically, while typical applications were described.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

The Value of the Radio Set

Referring to the leaderette "A Useful Guide" in your issue of November 1st, those who belittle the value of the radio set from the point of view of revenue earning cannot be sufficiently interested to make a careful and close analysis of consumers' individual consumption.

It has been my practice for many years to do this, and to give immediate attention to all cases of low revenue returns. The following example will serve to justify the views expressed by you in connection with the subject.

The returns from a housing estate consisting of 360 working-class houses revealed considerable variation in actual revenue returns. A careful examination was made of each consumer's installation with the following results:—

Revenue return per quarter, cost of energy 6d. per unit.

(a) 120 consumers' installations consisted of four lighting points, an iron, and an all-mains radio set, the expenditure at 6d. per kWh being 19s. 6d. per quarter. (b) 130 installations consisted of four lighting points and an iron, the quarterly return being 3s. 11d. (c) 110 consumers had an installation as (b) but with electric kettles and washing machines (14)—5s. 9d. per quarter.

This shows the need for close investigation of consumers' individual revenue returns, with a view to ensuring that electricity is not only available but actually consumed and in sufficient quantity to give a profitable return.

November 3rd. UNIT INCREASER.

Live Fire Flexibles

I was surprised to note, when looking through the electric fire lists of some leading makers, that one of the models shown—a 2-kW, two-bar fire—had a switch for each fire bar, so that the flex from the plug to the fire and the socket could be left alive, whether the fire was in use or not.

Now I have been taught that the flex if left alive may be dangerous. Moreover, this practice disregards I.E.E. Regulation No. 703D, which states:—"Where a switch or switches are provided on a luminous heating or cooking appliance fed from a socket outlet, one luminous section of the heating element, or alternatively a lamp on the appliance, shall not be controlled by such switch or switches so that it may serve as an indication whether the flexible cord and socket-outlet are live."

If my interpretation of the Regulation is correct, can there be any justification for an exception? M. D.

November 4th.

What is a Watt?

Most people think that a watt is about a mouse power; at first sight not an unreasonable supposition, when a kilowatt-hour is often sold for a halfpenny. A manufacturer, who was displaying a motor for driving an electric clock, was very proud of its high torque, seeing that it only consumed about one watt.

Investigation shows that a watt is a much larger unit of power than one might think. When James Watt introduced his steam engines he found by trial that a horse could do work on the basis of raising 30,000 pounds one foot per minute, but when certain people stated that their horses could do more than this he increased the amount to 33,000 pounds. A watt is one-746th part of this, say 44 pounds lifted a foot a minute or 1.18 tons lifted a foot an hour. This is equivalent to a ton lifted 28 feet a day, which power would probably be capable of running Big Ben at Westminster. It is therefore not surprising that it should be capable of running an electric clock or a meter.

The astonishing thing is that there is so much energy in a pound of coal, which in a modern station will give a kWh. We have concentrated largely on making generating plant more efficient, but there is room for improvement in the methods employed for converting electrical energy into useful work. C. TURNBULL.

Tynemouth, *November 8th.*

An effective window arrangement advertising electric irons which formed an exhibit at the recent Salon de la Lumière, Paris (See page 671)

All-electric Houses

I am pleased that Mr. Gostick admits the problem of the masses, but I do not think that he has seen the houses in Manchester to which I referred. I agree that it is a poor water-heating installation that does not get hot until 11 a.m., but that is not an example of what can be done—it is an example of what is done.

I agree with Mr. Noel Carrington that the Ministry of Health should publish figures of sickness and death from polluted air, but, at the same time it should, if possible, publish figures of sickness and death from the lack of heat. I admit the pollution of the air by smoke and much can be done to reduce it, but I am certain that more sickness is caused by lack of heat than by smoke.

It is, therefore, worth the serious consideration of all, to provide economical lighting, heating and cooking for the masses, and to achieve this a standard of cost should be established. I suggest that this standard should be, say, 3s. per week for a cottage with two or three bedrooms for four persons. If this standard can be achieved (and I believe it can) then anything above the figure of 3s. per week is a tax on the tenants, and I am sorry to say that many people have to pay this tax owing to the policy of local officials pushing gas and electricity when they know it to be uneconomical.

The country seems to be led by the cry of cheap rents to neglect cheap running costs. Electric heating at 2d. per unit and small gas fires at 1d. per hour are smokeless but expensive, and what are the results? Electric water heaters are installed and abandoned and all-electric houses are built and then converted to coal-electric. Nevertheless, the nearly-all-electric house is worth while but the cost should not exceed the figure which I have given. G. MARSHMAN.

Further to Mr. H. C. Gostick's letter of October 28th and Mr. W. Spencer's of November 8th, I would say that my "all-electric" house contains the following apparatus: Cooker, "Sadia" water heater (12 gal. size), copper, a 2-kW fire, two 600-W radiators and generous lighting. No coal or gas is used at all, and there are four in family with plenty of jam making, cake baking, &c. The cost for the last year, which is a fair average, is as follows: 6,360 kWh at ¼d. per kWh plus £1 16s. fixed charge and 4s. meter rent, £16 7s. 1d., giving an average charge of 0.577d. per kWh, the weekly average cost being 5s. 11d.

This compares very favourably with other fuels and reduces work, dirt and damage to decorations. We have a constant supply of hot water available day and night, the water heater never being switched off. No big laundry work is done at home, but the copper is used for fine things every week, and there is also an electric iron and hair dryer, and at least six hot baths per week. A. L. CARY,

Director, Cary, Hallewell & Co., Ltd.

Northfleet, Kent, *November 9th.*

With regard to the recent article on "The Nearly All-Electric House" and the subsequent discussion which it has evoked, I notice that in all cases related a unit charge of round about ¼d. is quoted with a standing charge of, say, £3 to £4. My experience therefore may be of interest.

I live in a rural district, about four miles from the borough of Chesterfield. My house, built about five years ago, is rated at £18 per annum. When building, although there was no supply in the district at the time, I had the house wired intending to take a supply, if and when it became available. I had no fireplaces built in the bedrooms, as I thought of electric heating in the future, and in the meantime had gas fires fitted.

Some time after the supply became available I wrote to the supply authority inquiring for particulars of its two-part domestic tariff. I received the following: For quarters ending June and September, 17s., plus 1d. per kWh; March and December, £1 8s., plus 1d. per kWh. Alternatively, June and September, £1 2s. 8d., plus ¾d. per kWh; March and December, £1 17s. 4d., plus ¾d. per kWh. The first arrangement works out at £4 10s. per year, plus 1d. per kWh, and the second £6 per year, plus ¾d. per kWh.

This contrasts with part of the same rural district which comes within the Sheffield Corporation's supply area, where a standing charge of from £2 10s. to £3 per annum with a unit charge of from 0.6d. to 0.75d. is available for similar premises. Having experience of the cost of gas supplied and also taking into consideration the extra cost of decoration, &c., with gas, I turned the matter down as being distinctly uneconomic.

A business friend in the same district had a supply connected to the premises, being one of the first consumers. He had a splendid light to start with, but as more consumers were connected it gradually diminished until it was almost impossible to read a newspaper with a 100-W lamp in quite a small room. I may say that he is situated at the farthest point from the transformer. Eventually, a complaint was made to the supply authority with the result that an inspector came down to investigate. He came, however, in the middle of the day, in early summer, when there was appreciably no load on the mains, and decided that there was nothing wrong. I should certainly have thought that the time to make a test of this description was when the mains carried maximum load. Eventually, I suggested that 240-V lamps should be fitted (the supply is at 250 V), and this resulted in a considerable improvement.

I have been connected with the electrical industry for the last twenty-five years and have been a reader of your paper for a large part of this time, and naturally I have the interests of the industry at heart, but under such conditions as those quoted I am afraid that the electrical Utopia for which we all look, will be a long time coming. A. WILKES.

North Wingfield, Nr. Chesterfield, *November 9th.*

The Value of Qualifications

I was very interested in the remarks of "Aspirant" in your issue of November 8th with regard to the usefulness of certain qualifications to an electrical engineer.

I would be grateful to readers for their opinion on the value of the following qualifications, in view of those which I already have. I hold the B.Sc. (Eng.) degree, have passed the A.M.I.E.E. examination and Sections A and B of the A.M.I.Mech.E. examination, and I am sitting for Section C shortly. I have in mind the following additional qualifications: M.Sc. (Eng.), Ph.D., B.Sc. (Mathematics)), B.Sc. (Physics), and A.M.Inst.C.E. My age is twenty and I have just started the practical side of my chosen branch of electric traction.

November 9th. YOUNG ASPIRANT.

The possession of a university degree of any kind, especially with honours, should be of great advantage to anyone at the commencement of his career. To take up examination work at a later stage has not quite the same advantage; it is conceivable that it might be rather a hindrance. Better that a man should devote his full energy to the performance of his duties.

As Prof. Blackie remarked in his book, "Self Culture," studying is not conducive to good health. In the higher appointments, other factors of equal if not greater importance than knowledge or capability are taken into account by those who engage men.

November 11th. W. E. P.

Cheap Electricity?

It appears to have escaped general notice, judging by the absence of comments in the electrical Press, that the efforts sponsored by the Government for improving (*sic*) the conditions of the coal industry will evidently be at the expense of the public utilities and especially electricity. I refer to the setting-up of coal marketing or central selling boards. Do the Electricity Commissioners realise to what degree this may retard the advance of electricity sales? The grid scheme was evolved to supply cheap electricity by methods of generating only at base load stations or stations of recognised efficiency, and the elimination of inefficient plant. Generation costs have undoubtedly been reduced to the benefit of users as a whole, and this has not escaped the notice of colliery owners who see a reduction in the sale of house coal owing to the increased use of electricity for domestic uses. They therefore intend to increase the prices of coal for electricity generation and simultaneously decrease the cost of domestic coal, thereby creating a greater demand for this commodity and retarding electrical progress.

With the formation of coal selling boards, the primary cost of generation will be in their hands and at their discretion by manipulation of coal prices. What then becomes of the grid scheme for reducing generating costs when selling boards increase costs far and above any gain effected by improved thermal efficiencies?

The excuse offered is the necessity of increasing miners' wages, but what explanation is given for probable increases of 25 per cent. in the cost per ton, plus a contract clause covering any and every increase to miners' wages? I am sure that nobody connected with the electrical industry will quibble at a wages clause in any fuel contract; what should be objected to is the projected increase in coal prices in addition to this wages clause.

Consider the position of numerous undertakings which have used every endeavour to promote the use of electricity to every class of consumer by reducing tariffs to a bare working margin and getting by these methods numerous domestic consumers who cannot afford to pay more.

Electricity is now a national commodity of paramount importance to industry and to the nation's health, and it should not be put at the mercy of colliery owners. I would suggest that as the Government has sponsored the formation of coal marketing boards it should also insist on receiving adequate and concise reasons why fuel prices to any generating station should be increased by more than is necessitated by a wages clause in contracts. GRID.

November 8th.

A Disputed Claim

I note in the current issue of your paper that the City Treasurer of Glasgow, Mr. P. J. Dollan, claimed that Glasgow's electricity was the cheapest in the world with the exception of the Niagara hydro-electric undertaking.

For the year ended May, 1935, the average price obtained in Glasgow for private supply was 0.91d. per kWh and for total supply 0.90d. per kWh. I should like to give you figures from other towns in pence per kWh.

Town.	Private Supply.	Total Supply.
Accrington	.84	.81
Coventry	.81	.80
Darlington	.67	.57
Gravesend	.85	.86
Huddersfield	.90	.86
Lancaster	.76	.67
Luton	.81	.75
Rochdale	.80	.79
Rotherham...	.64	.48
St. Helens	.80	.70
Sheffield	.86	.84
Stratford	.71	.68

I cannot think that Mr. Dollan would make statements which are not accurate and it would be very interesting to have the comparison of charges between, say, Glasgow, Darlington, Rotherham and Stratford, if Glasgow's electricity is the cheapest in the world. A. J. ABRAHAM.

Bexley (Kent) Electricity Dept., *November 11th.*

Motor-car Voltages

There appears to be much misapprehension regarding the best voltage for the starting, lighting and ignition of motor cars. It is often said that better headlamps can be obtained for a 12-V than a 6-V system. This view is largely based upon the fact that American car headlamps are not so powerful as those fitted to English cars, which, in the main, use 12 V. Consequently the 6-V system is thoughtlessly regarded as incapable of supplying the necessary current for adequate headlamp illumination, although, of course, it is a question of watts, irrespective of whether the voltage be 6 or 12.

It should be remembered that there are stringent laws against the use of glaring headlights in America, where roads are white, or nearly so. They reflect the light (as they should do) and do *not* absorb it as do our nearly black tarred macadam roads in this country. I am using a car equipped with 6-V lighting and starting, and fitted with headlamps which permit me to see four telegraph posts ahead so that current for illumination is evidently quite adequate.

In my opinion there are many reasons for the standardisation and adoption of the 6-V compared with the 12-V system. Starters and generators are cheaper to manufacture and repair; lamp filaments are more robust; ignition coils are cheaper to manufacture and replace; batteries for the same weight can be of very much greater ampere-hour capacity, can be produced more cheaply and have only three cells to maintain instead of six, so the chances of failure are halved.

Your readers' views upon this subject would be appreciated.

London, S.E.11, *November 11th.*

E. R. FORD,
Managing Director,
Autocar Electrical Equipment Co., Ltd.

D

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Floodlight Projectors

The long-range floodlight projector introduced recently by MESSRS. DAVIS, LTD., 36, St. Martin's Court, Charing Cross Road, London, W.C.2, is intended for showing up detailed parts of a building exterior, but it is equally suitable for indoor use and can be supplied on a portable stand as a spotlight, with colour screen arrangements. It is claimed that with a 60 W lamp its effective range is 600 ft.

The Davis floodlight projector

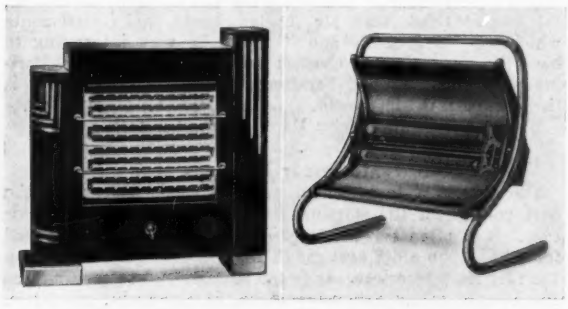
The projector is designed to have a long-range parallel beam with a focusing adjustment of approximately 10 deg. All parts are easily accessible, and while it is suitable only for single-phase a.c. it can be supplied for several voltages. The dimensions are: height, 22 in.; diameter of floodlight, 9½ in.; and weight, 26 lbs.

The model F.5742 floodlight projector of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, gives a narrow or medium angle beam depending on the type of lamp and front glass employed. Either a 500-W or a 1,000-W general service lamp or Class B.2 projector lamp can be used. The apparatus has a copper body with a chromium-plated reflecting surface. It is supplied with a heat-resisting frosted front glass, clear front glasses being provided if required. The finish is "Silverlac" and the dimensions are 25 in. high by 11¼ in. deep by 20½ in. in diameter.

Electric Fires

The latest catalogue of "Redot" fires supplied by LIGHTING TRADES, LTD., 51, Garratt Lane, Wandsworth, London, S.W.18, contains a number of new lines, two of which are illustrated below. The most striking of the new range is the No. E.30195, a modern and unusual design of fire, available in sprayed silver or copper, or red, green or blue cellulose.

No. 30202 has a chromium-plated reflector held in a ½-in. tubular stand. A similar tubular stand, but of ¼ in. diameter, is used for a new 11 in. diameter 600-W bowl fire.



Two new 2-kW "Redot" fires: Nos. E.30202 and 30195

There is also a very low-priced 600-W reflector fire with a tubular element and a polished aluminium reflector.

Switch and Fuse-gear Developments

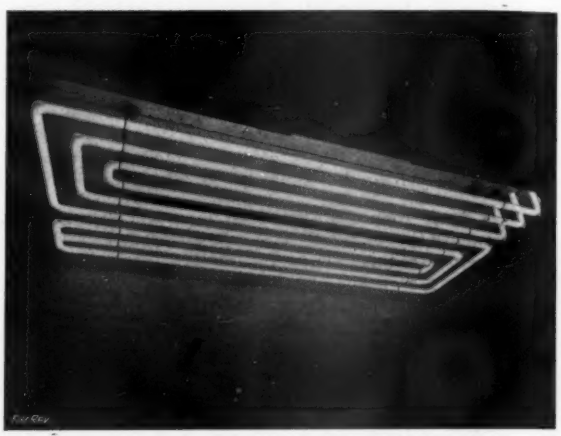
A list of switch- and fuse-gear which we have received from the SIMPLEX ELECTRIC CO., LTD., 159, Great Charles Street, Birmingham, 3, contains a number of new designs. There are a 30-A double-pole weatherproof switch-fuse with three knock-out clearance holes at the top and bottom, a two-way 30/15-A splitter type switch-fuse with two-way wood bushed or screwed outlets for house service work, and a similar type of 45/30-A switch splitter.

A 15-A single-pole cut-out incorporating a fuse unit in a watertight case has also been introduced, with a 30-A d.p. ironclad switch for industrial purposes. A 15-A d.p. switch with a 500-V rating for neon sign control (indoor use) incorporates a key handle, which can be removed only when the switch is in the "off" position. A "fireman's switch" rated at 15 A d.p. and finished as standard in red enamel is intended for outdoor use and has a ring handle for pole operation. To the range of d.p. 500-V iron-clad switch-fuses a 40-A size has been added.

For the control of portable motors where the switchplug requires to have a maximum voltage of 500 between the phases, a special triple-pole weatherproof 15-A switch-fuse with an interlocked plug has been introduced. A cooker-boiler change-over switch makes it impossible for an immersion heater or wash-boiler to be in circuit at the same time as the cooker. It consists of a d.p. 30-A change-over switch fitted with a rotary indicator. The auxiliary circuit consists of a 5-A switch controlling a 3-pin 5-A plug and socket, protected by a s.p. fuse. This circuit is connected to the incoming side and is therefore "live" on both positions of the switch. A d.p. cut-out should be inserted at some point in the incoming mains for convenient isolation and protection. There are also new ranges of distribution boards rated at 250 V, 10 A, and 500 V, 15 A.

A Remedy for Daylight Variability

The variability of daylight at different times of the day, seasons of the year and in different parts of the country can seriously affect uniform production in important branches of industry. As it cannot be controlled, colours of similar hue often seem to vary during changing periods of natural daylight, preventing the accurate matching of colours. A new lighting system known as "Claudegen" artificial daylight (CLAUDE-GENERAL NEON LIGHTS, LTD., Queen's House, Kingsway, W.C.2) is claimed to maintain an absolutely constant standard of light and to enable the most delicate shades of colour to be matched to a degree of accuracy which cannot be attained in natural daylight. Further, it has been found that this method of lighting permits of the detection of blemishes in finish or texture during manufacture, and so prevents the error being perpetuated throughout all the processes of manufacture.

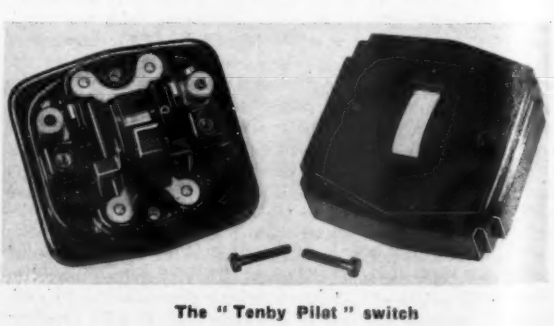


A "Claudegen" daylight unit

A New "Tenby" Switch

A shallow 5-A switch of reliable construction at a moderate price has been introduced by MESSRS. S. O. BOWKER, LTD., Regent Row, Birmingham. It is known as the "Pilot" and embodies a special q.m. and b. movement, enabling a long break to be obtained despite the shallow dimensions. As in the case of "Tenbyluxe" switches the circuit is broken in two separate channels, which protect the operating mechanism from any arcing that may occur.

Two patterns are available, one for mounting on standard wooden blocks and another for mounting on the special "Tenby Pilot" bakelite block. The depth of the block is ½ in., the overall depth of switch and block being 1¾ in. The standard finishes are brown and walnut on white, but matched or contrasting colours can be obtained to order.



The "Tenby Pilot" switch

Hackney Municipal Laundry

ALTHOUGH the general heating arrangements are not electrical, there is a considerable amount of equipment that depends upon electricity at the new public washhouse recently opened by the Mayor at Hackney. Both the washing machines, of which there are six, each with a capacity of forty shirts, and the six mangles are belt-driven from shafting operated by Bull motors in combination with Brookhirst straight-on automatic contactor starters, the mangles being provided with safety trips. The washing machines are in two groups of three, and between them there are two Watson, Laidlaw hydro-extractors. Twelve G.E.C. 600-W, 7½-lb. electric irons are available for use, and other electrical equipment includes a motor-driven accelerator in the boiler house and a centrifugal fan in the drying room. The specification for the electrical installation was prepared by the Electricity Department and the work was carried out under the supervision of Mr. E. A. Mills, the borough electrical engineer.

The facilities available have already been much in demand, and it is anticipated that the development of the new housing estate at Hackney Marshes will necessitate extensions. To this end provision has been made for the present 25 h.p. of electric motors to be increased by about 20 h.p.

Three views of the laundry equipment in the new public washhouse at Hackney

Chile's Electrical Imports

GREAT Britain improved her position in the electrical import trade of Chile in 1934 but still took but a small share of the total turnover. The aggregate value of such apparatus imported was £210,000 as compared with only £121,000 in 1933 and £183,000 in 1932. The greatest advance was made by the United States, with £138,000 as against £53,000 in 1933, while Germany came next with £30,000 as against £32,000 in 1933 and £59,000 in 1932. The following table gives imports in the chief groups in 1934, with a note of increase or decrease compared with 1933. (Peso=6d.)

	1934 pesos (thous.)	Inc. or Dec. pesos (thous.)
Lamps—		
Total	1,260	− 490
From Germany	305	− 325
„ United States	551	+ 70
„ Holland	57	− 145
„ United Kingdom	13	+ 2
„ Japan	195	+ 114
Wireless valves and earphones—		
Total	286	+ 82
From United States	170	+ 33
„ United Kingdom	12	− 10
„ Holland	83	+ 58
Telephone apparatus—		
Total	249	+ 153
From United States	66	+ 26
„ United Kingdom	42	+ 31
Telegraph apparatus—		
Total	65	+ 40
From United Kingdom	7	− 5
„ Germany	55	+ 55
Radio-telegraph apparatus—		
Total	8	− 10
From United Kingdom	5	− 4
Radio receiving apparatus—		
Total	2,317	+ 1,761
From United States	2,236	+ 1,724
Radio transmitting apparatus—		
Total	8	− 8
From United States	7	− 7

	1934 pesos (thous.)	Inc. or Dec. pesos (thous.)
Motors—		
Total	415	+ 199
From Germany	120	+ 100
„ United States	196	+ 103
„ France	27	+ 8
„ United Kingdom	7	+ 2
„ Sweden	32	− 15
Turbines—		
Total	18	− 27
Insulators—		
Total	60	+ 54
Cables and insulated wire—		
Total	620	+ 94
From Germany	132	− 9
„ Belgium	12	− 109
„ United States	280	+ 87
„ United Kingdom	177	+ 141
Carbons and electrodes—		
Total	368	+ 93
From United States	336	+ 146
Dynamos, alternators, convertors and unspecified elec. machinery—		
Total	152	− 23
From Germany	23	− 86
„ France	—	− 36
„ United Kingdom	72	+ 63
„ Switzerland	10	+ 10
„ United States	40	+ 28

	1934 pesos (thous.)	Inc. or Dec. pesos (thous.)
Transformers—		
Total	277	+ 233
From Germany	70	+ 63
„ United States	153	+ 137
„ United Kingdom	25	+ 8
Resistances—		
Total	70	+ 11
From United States	49	− 8
„ Germany	6	+ 6
Unspecified elec. apparatus—		
Total	254	+ 123
From Germany	168	+ 139
„ United States	51	+ 20
„ United Kingdom	10	− 61
Current meters—		
Total	264	+ 100
From United States	207	+ 148
„ Switzerland	3	− 47
Batteries—		
Total	214	+ 103
From Germany	15	+ 2
„ Denmark	18	− 2
„ United States	145	+ 78
„ United Kingdom	20	+ 12
Accumulators—		
Total	826	+ 626
From United States	665	+ 520
„ France	30	− 1
„ United Kingdom	78	+ 64

Electricity in New Zealand. By R. L. Smith

A review of the registration, supply and installation systems in force

UPON numerous occasions engineers, contractors and wiremen have given their opinions on registration in the ELECTRICAL REVIEW, and all of them seem to agree that some form of registration would be preferable to the present chaotic conditions. Compulsory registration of wiremen and contractors has been in force in New Zealand since 1926, under the administration of a Wiremen's Registration Board. The Board comprises the chief electrical engineer of the Public Works Department, who is chairman, and representatives of the various associations concerned in the electrical industry, including the Electrical Workers' Union and the Council of Fire Underwriters. The expenses of the Board are met by registration and examination fees, and a levy upon the supply authorities.

A candidate for registration under the Registration Act, must have had a minimum of three years' experience in the trade; he must pass the Board's examination in theory and practice; and must have attained the age of nineteen years. The theoretical examination covers electrical theory, calculations, problems in installation, and a knowledge of the regulations. The practical part is a thorough test of the candidate's fitness for electrical installation work, and his ability to put his knowledge of the regulations into practice.

Provisional registration is sometimes granted, in special instances—generally in the case of an improver who has served a five years' apprenticeship, and has sat for but failed at the examinations. Provisional licences are valid for six months. The examinations are held twice a year.

Limited Registration

An attempt is being made to introduce a limited registration system to apply to radio service men, but this as yet is not compulsory. These people, who are numerous, lack the knowledge of the skilled wireman, but are allowed to install all-mains radio sets, often in a hazardous manner, involving infringements of the regulations.

The radio service man's licence permits the installation and "servicing" of radio sets, but does not entitle the holder to carry out the actual wiring, or to interfere with existing wiring.

The regulations governing wiring and installation work are based in general on the I.E.E. Rules and British Standard Specifications, adapted to New Zealand conditions, and are rigidly enforced. They provide that no installation work shall be carried out by any other person than a registered wireman, with or without the assistance of an apprentice or improver, working under his supervision and in his presence.

The employment of an unregistered, and unlicensed wireman renders the employer liable to a fine of £20, and failure by the wireman to produce his registration certificate on demand by authorised persons (such as a supply engineer) renders him liable to a fine of £10. The installation work has to be inspected by an authorised inspector appointed by the supply authority. An authorised inspector is a person registered under the Electrical Wiremen's Act who has been employed in installation work.

A permit is required from the supply authority before commencement of the work. On completing an installation, repairs, additions, etc., the wireman in charge has to fasten a label to the switchboard bearing details of the installation; the contractor's name and address, and the wireman's signature and licence number. This label may only be removed by an authorised inspector, and enables responsibility to be fixed if any fault should occur at a later date.

Negligence and disregard of the regulations on the part of the wireman renders him liable to a penalty and even cancellation of his licence may result. An inspection and test of the installations are carried out every five years to ensure that they are still in a safe condition.

The Electricity Supply System

Electricity supply in New Zealand is in the hands of a large number of authorities operating under a limited licence from the Government. The supply in the majority of cases is purchased in bulk from the Government hydro-electric schemes.

Distribution and general supply are mainly by overhead lines, underground cables being used only in the business areas of the large towns. Distribution lines are operated at 11,000 V and 3,300 V, and the supply is stepped down to 230/400 V three-phase for distribution. Main sub-stations are supplied by 110, 66 and 50 kV grid transmission lines.

Many of the supply authorities still retain their original power plants as a stand-by for emergency, or in a few cases for peak-load periods. The electricity supply authorities erect and maintain distribution equipment but in the main do very little internal installation work, which is left to the contractors.

Screwed conduit is almost always used in New Zealand; grip or slip-joint conduit is no longer allowed and c.t.s. cable, lead covered cable, and cleat wiring may only be used in special circumstances, and then only with the written permission of the supply authority.

The regulations as they affect domestic and industrial buildings call for screwed conduit, v.i.r. cable (600-megohm grade), the loop-in system with no joints in the wiring beyond those at the outlet points, switches or ceiling roses. Sufficient space must be allowed in the conduit for the easy withdrawal and replacement of cables. All conduit joints must be tightly screwed, and outlet points secured with gland boxes or flanges, fibre or compound bushes not being allowed. Boards for mounting fuses, switches, meters, etc., have to be of an "approved" compound material or of the ironclad type. Switchboard panels are mounted on brackets at a minimum distance from the wall according to size, and all wiring must be at the rear. A wooden casing around the panel, often with a glass door front, generally completes the switchboard.

The Domestic Installation

The average modern residence is equipped as follows:—In the hall is a pendant light with two-way switching. The front room has two lights, separately switched, one plug point for a radiator and one for radio. In the kitchen is a pendant lamp, a plug point for an electric kettle or iron, an electric range, and a hot water cylinder. The principal bedrooms have bracket or pendant lighting fittings, two-way switching, with radiator and lighting plugs. The other rooms are, of course, electrically lighted.

The use of electric cookers is not so wide as could be desired; their number is only about 20 per cent. of the number of gas cookers in use. Electric water heating is gaining wide popularity. The type of cylinder used for the average family is of about 30 gallons capacity, with a 600-W or 750-W element. The charges for this service are on a monthly flat rate basis according to the size of element used. The heaters are controlled manually and by time switches, the latter being set to cut off the supply during peak-load hours. In some of the more populous districts, the cylinders are on a separate phase supply, controlled from the sub-station. The use of this system, has enabled the supply authority to reduce the hot-water tariffs, for despite the expense of the extra supply lines, it reduces the peak load by limiting the use of the heating current to the slack hours. As bulk supply is purchased on a maximum demand basis the advantage of this is obvious.

The use of domestic refrigerators and washing machines is not very extensive. High first cost is mainly responsible, especially in the case of refrigerators—the price of the cheapest being in the region of £50.

Larger Establishments

Industrial installations are of varying character. They include the large public buildings, hotels, factories and freezing works in the business areas of the towns. The installation of farming machinery, milking machines, shearing machines, pumping plants and all the requirements of modern farming has made good progress in the country areas.

Modern business premises have electrical installations comprising lighting, heating, machinery, and in some "conditioned air." Shop lighting is by chain pendant fittings, or indirect systems employing concealed reflectors. Tubular heaters at present are finding great favour and great interest is being shown in air conditioning especially in cinemas, public halls and the larger shops. Many of the large hotels are equipped with electric kitchens.

Despite the desire to promote the greater use of electricity there are very few hire systems, although hire-purchase methods are operating. The matter is being considered, however, in the light of English experience, and it is probably only a question of time before such schemes become popular in New Zealand.

Electricity at Geneva

Included in a booklet "The League Buildings, Geneva," recently published by Messrs. Allen & Unwin (price 6d.) are some interesting facts about the electrical installation in the new building for the League of Nations. The total loading is 2,000 kW and annual consumption is expected to be 1 million kWh; there are 9,000 points, 100 electric motors, 24 pumps and 21 lifts. Twenty-three kilometres of armoured cable are used and 212 km. of conductors. In addition there are 101 sectional switchboards and 950 telephones.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

B.I.F. Contracts

Contracts to the value of £16,000 have been let for the extension of the British Industries Fair buildings at Castle Bromwich, Birmingham. These include electrical work, which is to be carried out by the Springvale Electrical Co., of Kensington, W.14. The building marks the beginning of a new type of construction for the Fair, the metal roof having steel stanchions and steel lattice girders. In many cases exhibitors are co-operating in the supply of materials.

Ealing Electrical Exhibition

Until November 23rd the Ealing Corporation Electricity Supply Department, with the assistance of several manufacturers and local contractors, is holding an exhibition at Electricity House, Uxbridge Road, Ealing. Electric cooking demonstrations are being given twice daily at 3 and 7.30 p.m., and there are continuous demonstrations of other labour-saving devices. In addition to the all-electric house which is a permanent feature of the premises, window displays and attractive stands erected around the main showroom have been prepared by the following:—Beatty Bros., Ltd.; Belling & Co., Ltd.; Berkeley & Young, Ltd.; Berry's Electric, Ltd.; British National Electrics, Ltd.; British Vacuum Cleaner & Engineering Co., Ltd.; Bulpitt & Sons, Ltd.; Burnley Components, Ltd.; Eureka Vacuum Cleaner Co., Ltd.; Falk, Stadelmann & Co., Ltd.; Falkirk Iron Co., Ltd.; General Electric Co., Ltd.; H.M.V. Household Appliances, Ltd.; Hotpoint Electric Appliance Co., Ltd.; Revo Electric Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Simplex Electric Co., Ltd.; Smith's English Clocks, Ltd.; Thermega, Ltd. The Electricity Department and the official Corporation contractors also had stands of their own, as well as the Electrical Association for Women. Formally opening the exhibition last Saturday, the Mayor of Ealing, Alderman J. J. Lynch, declared that since 1925 the number of consumers in the town had increased from 8,000 to over 18,000, and the annual sales of electricity from 3,300,000 to 14,300,000 kWh. The Mayor was supported by Councillor J. M. Lewis, chairman, Councillor F. F. Woodward, vice-chairman, other members of the Electricity Supply Committee, and Mr. R. Birt, the borough electrical engineer and manager.

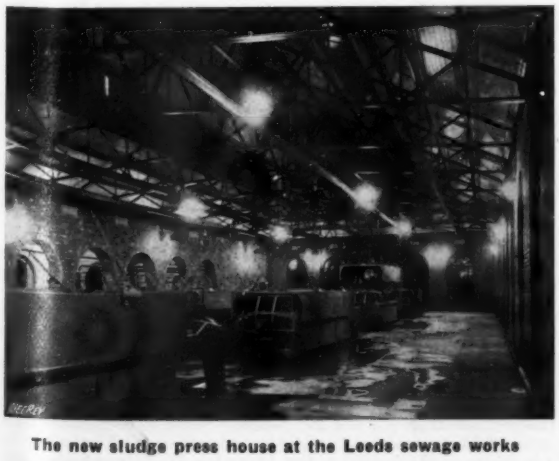
The Radio and Gramophone Handbook

The 1936 edition of *The Wireless and Gramophone Trader* Year Book and Diary which has just been published contains information indispensable to radio and gramophone traders. In the directory section are a buyers' guide arranged alphabetically under 200 classes of goods; 1,200 addresses of manufacturers and wholesalers, with telegraphic and telephonic details; and 1,300 proprietary names of radio and gramophone products. New features include a summary of the Television Report and an article describing the principles of television. The 1935-36 receiver specifications for 400 sets are given and the valve reference tables have been revised and brought up to date. Diagrams are also given of British and American

A section of the exhibition at Electricity House, Ealing, and (right) the cooking demonstration room

Sewage Works Lighting

THE electric lighting equipment for the new sludge press house which has been added to the Knostrop low level section of the Thorpe Stapelton sewage disposal works of the Leeds Corporation was manufactured by Holophane, Ltd., supplied by the Sun Electrical Co., Ltd., and installed by Messrs. Green & Smith, Ltd., electrical contractors, Leeds. The total wattage amounts to 16,120, varying from 0.3 W per sq. ft. in the sludge loading room to 0.88 W per sq. ft. in the compressor room. The total number of lights is 97, with 47 switches. The fittings used are of 60, 100, 200, 300, and 500-W sizes, the types including "Widerlite," reflector, indoor and outside lanterns, and special wall reflector lanterns for the sludge press house. Since ammonia fumes are usually present, a v.i.r. metal-sheathed wiring system was recommended with the metal sheathing protected with braiding impregnated with compound. To provide waterproof joints the cables have been soldered into solid alloy glands screwed into fittings and boxes. All fuseboards, switches, junction boxes, switch-plugs and sockets are of the waterproof pattern with watertight light lids, having a sherardised finish.



The new sludge press house at the Leeds sewage works

The lighting installation has been balanced, as nearly as possible, between the three phases of the supply from the Leeds Corporation at 346/200 V.

For all the high wattage fittings asbestos insulated heat-resisting flexible was used between the v.i.r. wiring and the lampholders, fixed porcelain interiors with terminals in circular or rectangular boxes being provided at each lighting point. The difficulty of satisfactorily lighting the tops of the press plates in the press house when the sheet steel covers were raised to their maximum extent was overcome by planning this section of the installation to give a combination of vertical and horizontal lighting by means of lanterns suspended from the roof trusses, and special wall reflector lanterns fixed on the walls at a suitable height. Another anticipated difficulty was in the sludge loading room under the press house, which is only 9 ft. high and is of very heavy girder construction with stanchions and also deep shutes for loading purposes. The results achieved by adopting 60-W "Widerlite" fittings are considered noteworthy, as with the 36 fittings the wattage per square foot is slightly under 0.3.

valve base connections. Other matters dealt with include the legal aspect of radio trading, licences, electrical interference, mains voltages in over 1,000 places and districts, and servicing information, while the technical, legal and general commercial information has been revised. The Year Book is priced at 5s. 6d. but subscribers to any *Trader* publication can obtain their copy for 3s. 6d. It is obtainable from the Trader Publishing Co., Ltd., Dorset House, Stamford Street, S.E.1.

Brussels Exhibition Award

The English Electric Co., Ltd., has been awarded the Grand Prix in Class 86 (internal combustion engines), Class 90 (industrial production of electricity), and Class 96 (electro-mechanics) in the competition which has been held in connection with the International Exhibition, Brussels. The exhibit comprised two Diesel generating sets, each set consisting of an "English Electric" 300 b.h.p. "K" type Diesel engine direct coupled to an "English Electric" 200 kW 3-phase, 50-cycle, 400/230 V alternator. The equipment included the main switchboard, comprising seven panels. The generating sets supplied the whole of the light and power requirements of the British Pavilion and the plant was operated throughout the duration of the exhibition by the company.

A Hire-purchase Scheme

Following the introduction of a hire-purchase scheme which the Connaught Trust, Ltd., is financing for the sale of "Xcel" domestic electrical appliances, a broadsheet has now been prepared illustrating in colour the various appliances which are available under this scheme. Special attention has been given to the colour-printing in an effort to reproduce exactly the appearance of the appliances. Under the scheme all the appliances illustrated can be purchased on easy terms of 1s. per week and upwards. Space is provided on the broadsheet for overprinting the name and address of the retailer.

Orders for Oil-filled Cables

British Insulated Cables, Ltd., has in hand some important contracts for cables in the London area. The Central Electricity Board and the Wimbledon Corporation have placed orders for an aggregate of 17,500 yd. of 0.25 sq. in. three-core 33-kV oil-filled cable and 16,037 yd. of solid-paper insulated cable of the same size and for the same voltage, with auxiliary cables. For its London transmission system, south-west area reinforcement section, the County of London Electric Supply Co. has ordered 62,640 yd. of 0.35 sq. in. single-core 66-kV oil-filled cable together with pilot and telephone cables. These contracts include the supply, laying, jointing and testing of all cables and the necessary trench work.

Electrical Blankets for Ambulances

Following the successful use of electrically heated blankets in hospitals, especially for "shock" cases, Thermega, Ltd., is now similarly equipping ambulances with blankets. For a short journey a blanket connected to the garage mains while the ambulance is standing by retains its warmth sufficiently, but where the distance is a long one a second blanket operating on either 6 or 12 V is switched on from the dashboard when the other is disconnected. Extremely good results are said to have been obtained by this method, and patients are often brought round before reaching the hospital.

Lighting in a Modern Hotel

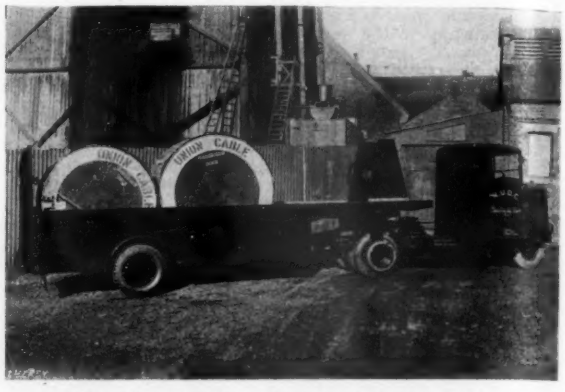
An excellent example of the suitability of architectural lamps for the lighting of the modern hotel is to be found at Saunton, Devon, where the public rooms of the Saunton Sands Hotel

Architectural lighting at the Saunton Sands Hotel

have been illuminated entirely with "Royal Ediswan" architectural lamps, specially amber tinted to match the internal decorations. This hotel, which was constructed in the modern style to the design of Mr. A. Underdown, F.R.I.B.A., has extensive lounge and dining rooms overlooking the sea. In these rooms the architectural lamps are fixed to the beam casings, while in the smoking-room, palm court and cocktail bar attractive wall brackets have been constructed with short architectural lamps mounted on plain wooden bases. This lighting is supplemented by other similar lamps placed at intervals along the ceiling. These lamps have also been used for the illumination of the main entrance, terrace steps, corridors and passages. The electrical installation in this new hotel was carried out by Ringmer Motor Works, Ltd., and all lamps throughout the building were supplied by the Edison Swan Electric Co., Ltd.

A New Trailer at Kettering

The Kettering U.D.C. Electricity Department has recently purchased a vehicle for the transport of transformers and cable drums. The vehicle, shown in the accompanying illustration, will carry up to seven tons, has a loading height of 18 in. and



Kettering Electricity Department's new vehicle

is fitted with a ramp tailboard and jacks to place under the rear end to facilitate loading. The drop portion of the trailer is 11 ft. 4 in. long by 7 ft. 6 in. wide and 4 ft. 10 in. between wheel arches. The Karrier "bob" tractor has a Treasury rating of 14 h.p. and will develop 44 b.h.p. It is capable of hauling full load at 20 m.p.h. and will climb a gradient of one in five. The brakes are operated from the driver's cabin when the vehicle is in motion, and by hand lever on the trailer when stationary.

Electricity and Gas at Darlington

The Darlington Town Council on Thursday last discussed a proposal of the Gas and Electricity Committee to appoint two canvassers at a salary of £200 a year each, to visit householders with a view to encouraging the sale of electrical equipment. The proposal aroused much opposition. Alderman Bates, chairman of the Finance Committee, in moving that the recommendation should be referred to the General Purposes Committee, said that the Committee was being pushed by the Electrical Development Association into an advertising campaign organised in the interests of privately-owned electrical concerns in other parts of the country. Why should the Corporation, which owned both gas and electricity undertakings, start on a scheme of advertising one of its departments to the detriment of another? "Although we are supplying at the lowest prices in Great Britain, they would if possible take us over to-morrow, and the price would then be nearer threepence a unit than a halfpenny."

Alderman Leach, supporting the amendment, said it was evident that big interests were pushing the claims of electricity, but he failed to see why the Council should be expected to advertise one department of the Corporation to the detriment of another. He added: "There will be no solution of a problem such as Darlington has to handle until an opportunity arises to have both departments under one head. That would put an end to bickering and competition. Anything more absurd than to have one committee in control of two rival and competitive departments I cannot conceive."

After considerable debate Alderman Leng, chairman of the Committee, said they had had a circular from the Central Electricity Board asking them to spend £1,000 a year in advertising. "If we do not do something to show we are pushing electricity," he said, "we may have to pay for it in the future." The amendment to refer the subject to the General Purposes Committee was carried by a large majority.

Hornsey Town Hall

For the electrical installation carried out at the new Hornsey Town Hall by Messrs. B. French, Ltd., under the direction of Mr. W. H. Bray, consulting engineer, a d.c. supply is taken from the Corporation's mains at 480 V for power and 240 V for lighting, a normal three-wire circuit being employed. Six main Record circuit-breakers feed the bus-bars, and Simplex ironclad switch- and fuse-gear controls the subsidiary circuits. The Administrative Section of the building is controlled and metered separately from the Licence Section, each having its own Chloride emergency lighting installation. The *pièce de résistance* of the building, the Assembly Hall, is notable principally for the variety of the lighting employed. The primary lighting comes from panels installed in the window-sills, small wall panels supplying the secondary illumination. The large

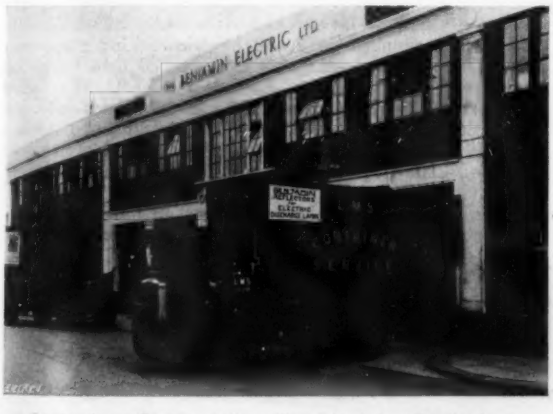
circular fittings of special design, together with a laylighting system (Benjamin reflectors) in the centre of the ceiling, are controlled from the stage board and the projector room by push-buttons connected with motor-driven dimmers. Disappearing footlights and two three-colour battens (Strand) comprise the stage-lighting equipment, while Reliance curtain control gear and public-address equipment (Standard Telephones & Cables, Ltd.) are other features. For washing hot water is provided by "Unity" water heaters of various sizes. Messrs. J. Jeffreys & Co., Ltd., have installed two separate plenum systems for air-conditioning, one for the Assembly Hall and one for the Council Chamber, and there are extraction fans for the offices, &c. This plant is controlled separately from the boiler-house by a Simplex 100-A isolator switchboard, Prento iron-clad switchgear, and Electrical Apparatus Co.'s starters. Duplicate "Super-Selfix" pumps driven by 25-h.p. Verity motors circulate the hot water through the radiator system. Solid nickel bronze has been used for the plates and dollies of the specially designed light switches and power switch-sockets (Tucker). The whole of the main conduit has been taken along the corridors in ducts, and J. & P. cable has been employed almost entirely. An internal telephone installation (New System Private Telephones, Ltd.), and a Synchronome clock system are other features of the building. Some of the lighting fittings were supplied by Messrs. Troughton & Young, Ltd., and Messrs. Best & Lloyd, Ltd., the remainder being specially designed by the architect in conjunction with the electrical contractors.

The Harrow Exhibition

A special attraction at the electrical exhibition this week organised by the Harrow Electric Light & Power Co., Ltd., and the Kenton branch of the North Metropolitan Electric Power Supply Co. is an electric garden, which includes a heated aviary, an electric fountain, a floodlight, a grass cutter, heated frames, apparatus for soil sterilisation and soil-heating cables. On the domestic side, in addition to cooker and vacuum-cleaner demonstrations, there are working models of washing machines and displays of all the usual small appliances. Electric sewing machines are shown, and there is an illuminated summer house. There are also displays of clocks, fires, refrigerators and radio sets, as well as the E.D.A. "Light Throughout the Ages" set piece.

Lighting Reflectors for Birmingham

The accompanying illustration shows a L.M.S. container being loaded at the works of Benjamin Electric, Ltd., with



Benjamin reflectors being dispatched to Birmingham

reflectors for electric-discharge lamps for dispatch to Birmingham. This is one of a fleet of similar containers which were used for this purpose.

Lighting at a B.B.C. Studio

In our Nov. 1st issue we reproduced pictures of the new Maida Vale studios, and mentioned that lighting fittings had been supplied by Messrs. Harcourts, Ltd., and Holophane, Ltd. Messrs. Frederick Thomas & Co., Ltd., now inform us that the fittings seen in our picture of a control room were supplied by them, as well as fittings in several other rooms.

Fuse Wire and Advice

We have received from Mr. George Humphry, 8, Bernard Gardens, Wimbledon, a card bearing small coils of 5-A and 10-15-A fuse wire for domestic use. The card also has upon it hints upon fuse renewal and advice to consumers regarding their installations.

Automatic Switch Reclosure

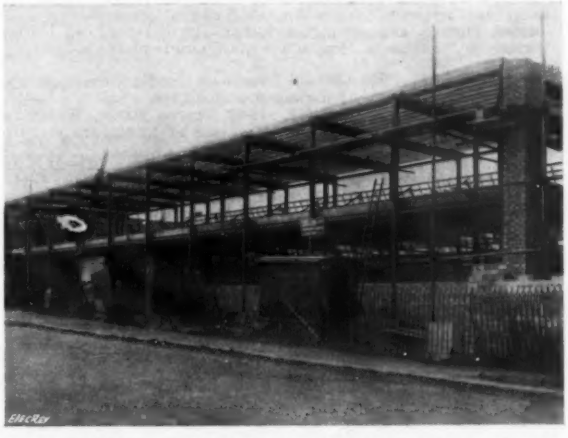
With reference to the Crompton solenoid switch-closing device with periodic self-resetting relays, described in our last issue, Messrs. Crompton Parkinson, Ltd., ask us to state that the relay itself is made by the Metropolitan-Vickers Electrical Co., Ltd.

New Municipal Showrooms

Middleton Corporation is to erect electricity showrooms and offices in Mill Street.

Cable Works Extensions

Extensions are being carried out at the Enfield factory of the Kniveton Cable Works, Ltd. The new buildings, extending over 50,000 sq. ft., will house plant for the manufacture



The New buildings of the Kniveton Cable works, Ltd., Enfield, in course of construction

of paper-covered cables, a new development on which the company is embarking. Our picture shows the new buildings in course of erection.

New Cable Works

We are asked to state that the Britannic Electric Cable & Construction Co., Ltd., is about to establish works for the production of high- and low-pressure paper- and rubber-insulated cables at Iver, Bucks. Details of the company's registration appear on page 694.

Orders Recently Booked

Messrs. J. Browett Lindley (1931), Ltd., have recently received an order for a steam-driven generating plant for a south coast creamery. This includes a 200 kW back-pressure steam engine driven alternator set for generating the total power requirements of the creamery. Process steam, at present taken direct from a boiler, will be supplied from the exhaust of the new engine. Extra process steam required from time to time will be taken direct from the boiler. An ejector condenser will also be supplied for the purpose of condensing the steam at periods when no process work is taking place. The new engine will replace two Diesel oil engine driven alternators. Other contracts include two 500 cu. ft. per minute two-stage tandem steam-driven air compressors and one 700 cu. ft. per minute two-stage motor-driven air compressor for Australian mines; a 1,000 cu. ft. per minute two-stage compressor and 100-kW steam-engine driven generating set for a South African mine; and a 110-kW steam-engine driven generating set for an Indian textile mill.

Among the plant supplied by International Combustion, Ltd., during the past month was a water tube boiler for the Derby Corporation, secondary air equipment for the Stockport Corporation Electricity Department, and two "L" stokers for the Brimsdown power station.

An A.c. Transformer Lamp

The Davis Electrical Co. informs us that the "Translamp" small transformer lamp is now entirely manufactured in this country.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, November 13th: No change in the price of copper bars (best selected), sheet and rod. English pig lead, £20 5s., 15s. inc. Spelter, £16 10s., 7s. 6d. inc. English block tin, £229 10s., £6 inc.

Messrs. Frederick Smith & Co. report, November 13th: No change in the price of electrolytic copper bars, wire rods and h.c. wire and silicium bronze wire.

Messrs. Edward Till & Co. report, November 13th: India rubber, Para fine, 6½d., ¼d. inc.

A Film Offer

The Hackbridge Electric Construction Co., Ltd., is offering to lend a number of engineering films to supply authorities, universities, technical colleges, engineering societies and other bodies interested in electrical engineering. These deal with such subjects as the manufacture, transport and installation of Hackbridge power transformers, and the manufacture and applications of Hewittic mercury arc rectifiers.

New Catalogues and Lists

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.1.—A booklet dealing with a recent test of Philips lamps by the National Physical Laboratory.

Siemens & General Electric Railway Signal Co., Ltd., Central House, Kingsway, London, W.C.2.—A leaflet on Edison primary cells.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A complete catalogue of iron-clad switchgear for industrial and house service use, and a similar range of all-insulated switch-fuses, service cut-outs and neutral connectors. Also a list of Christmas gift suggestions.

Siemens Electric Lamps & Supplies, Ltd., 38/39, Upper Thames Street, London, E.C.4.—A folder giving information in tabular form relating to "Full O' Power" radio batteries. Also a new catalogue of "Sieray" electric-discharge lamps, including fittings for street lighting and reflector units.

British National Electrics, Ltd., Newarthill, Motherwell.—A leaflet dealing with all the British National toasters.

Brook Motors, Ltd., Empress Works, Huddersfield.—A leaflet relating to "Empress" capacitor start single-phase motors up to 3 h.p.

Ferranti, Ltd., Hollinwood, Lancs.—A leaflet covering the whole range of the company's radio receivers.

J. G. Statter & Co., Ltd., 16, Great George Street, Westminster, S.W.1.—A leaflet giving particulars of miniature circuit-breakers and earth leakage trips.

W. H. Stone & Co., Ltd., 16, Hill's Terrace, Cardiff.—A pamphlet on "Don" electric irons.

Bulpitt & Sons, Ltd., Swansea Works, Birmingham, 1.—A folder on small electrical apparatus suitable for Christmas gifts.

International Combustion, Ltd., Aldwych House, Aldwych, London, W.C.2.—Catalogues on "Cableway" excavators and the "Hardinge" thickener.

Gent & Co., Ltd., Faraday Works, Leicester.—Publication No. 241, dealing with "Tangent" clocks and indicators for marine use.

Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, London, W.C.2.—A catalogue of radio receivers.

Bankruptcy Proceedings

S. G. Penrith, 50, Mount Pleasant, Barrow-in-Furness, electrical contractor, lately carrying on business at 14 and 5, Mount Pleasant.—The receiving order herein was made on the debtor's own petition, and at the first meeting of creditors held recently at the Official Receiver's Office, 16, Cornwallis Street, Barrow-in-Furness, the case being a summary one was left in the hands of the Official Receiver, as trustee.

L. E. Pearce (St. John's Electrical Co.), electrical engineer, 43, St. John's Road, Tunbridge Wells.—Last day for receiving proofs for dividend November 20th. Trustee, Mr. A. E. Orbell, 6-7, Old Steine, Brighton.

A. E. Beaumont, electrical and radio engineer, 216, Manchester Road, Thornton Lodge, Huddersfield.—Last day for receiving proofs for dividend November 20th. Trustee, Mr. F. H. Langmaid, 71, Manningham Lane, Bradford, Official Receiver.

G. Wiseman, radio dealer, 317-322, Walworth Road, S.E.—An order of discharge, subject to a suspension of six months, was granted to this debtor on November 5th.

D. Briggs, radio engineer, Eastwood, Pillmawr Road, Malpas, Monmouth.—Receiving order made November 4th on a creditor's petition.

W. C. Stephenson, wireless dealer, 1, Barnfield Road, Spennymoor.—Trustee, Mr. W. A. Ellis, 32, Frederick Street, Sunderland, Official Receiver, released October 29th.

L. W. Perrem, 20, Tavistock Road, Launceston, Cornwall, wireless engineer.—At the first meeting of creditors of this debtor held at Devonport on November 6th it was stated that the liabilities amounted to £123, and there were assets of £7. Debtor attributed his failure to competition and bad trade. The case being a summary one was left in the hands of the Official Receiver as trustee.

T. McKnight, electrical contractor and wireless dealer, 2, Brookfield Drive, Swinton.—Trustee, Mr. L. A. West, Byrom Street, Manchester, Official Receiver, released October 31st.

A. D. M. Mayer, electrical engineer and wireless specialist, 75, Pasture Road, Goole.—Application for discharge to be heard on December 10th at the Court House, Wakefield.

Company Liquidations

Dundas Fox, Ltd.—Winding up voluntarily. Liquidator, Mr. G. R. Lowe, River Plate House, Finsbury Circus, E.C. Particulars of claims to the liquidator by December 10th. Meeting December 23rd at River Plate House, to receive an account of the winding-up by the liquidator. All creditors have been, or will be, paid in full.

Silver Fox Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. G. R. Lowe, River Plate House, Finsbury Circus, E.C. Particulars of claims to the liquidator by December 10th. Meeting December 23rd to receive an account of the winding-up by the liquidator. All creditors will be paid in full.

W. P. Love & Sons, Ltd.—Meetings December 10th at 12, Lonsdale Gardens, Tunbridge Wells, to receive an account of the winding-up by the liquidator, Mr. P. Wickenden.

Leo Sunderland & Co., Ltd.—Particulars of claims by November 26th to the liquidator, Mr. C. F. W. Ross, Pinners Hall, Austin Friars, E.C.2.

Private Arrangements

C. H. F. Westlake, trading as W. J. Corse & Co., electrical engineers, 45, Station Road, Plymouth.—The creditors herein were called together recently when a statement of affairs was presented which disclosed liabilities of £4,016. The net assets were £1,488, leaving a deficiency of £2,528. A resolution was passed in favour of the estate being dealt with under a deed of assignment, with Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, London, E.C., and Mr. C. E. B. M. Smith, of Plymouth, as joint trustees, with a committee of inspection consisting of the representatives of the General Electric Co., Ltd.; Callenders Cable & Construction Co., Ltd.: Simpson Baker & Co., Ltd.; and Mr. A. M. Sanger and Mr. M. Willcocks.

An Electric Works Canteen

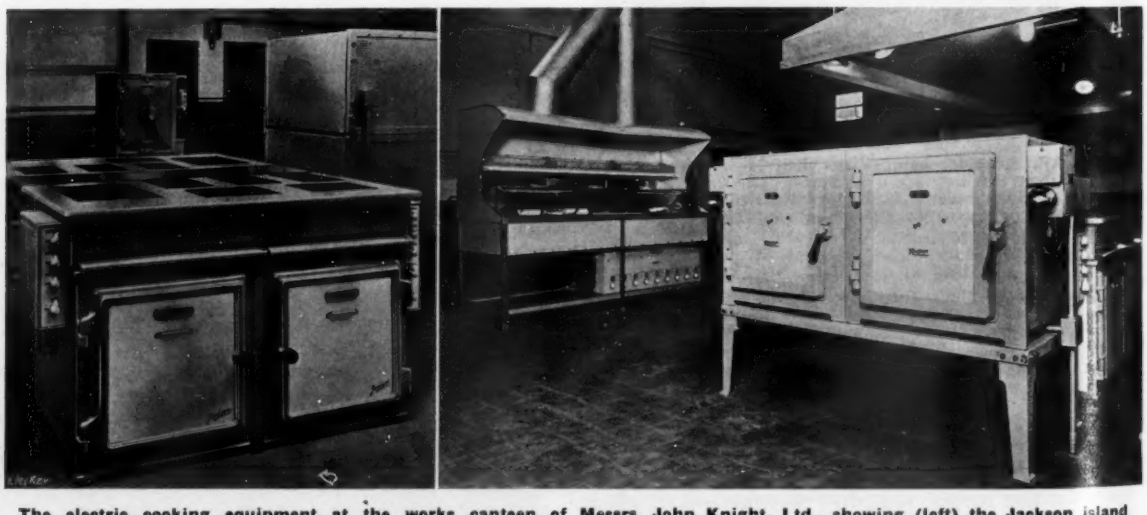
WITHIN recent years Messrs. John Knight, Ltd., have so extended their soap works at Silvertown, and consequently increased the number of their employés, that the provision of enlarged canteen accommodation became necessary, and a new hall was officially opened on October 29th. This building covers a total area of 13,000 sq. ft.. and the hall, which is designed both as a restaurant and for social activities, will comfortably seat 600 people at meal times. The kitchen is fully equipped on modern lines, and is practically all-electric.

The electric cooking equipment, supplied by the General Electric Co., Ltd., consists of a double-compartment type roasting oven, a double-deck pastry oven, and a three-pan "Magnet" fish fryer complete with canopy, splashguard and draining racks. Other G.E.C. auxiliary units include a double griller mounted on a stand, and a bank of four 10-gal. vegetable boilers, and an egg poacher and boiler.

The kitchen equipment also includes electric cooking apparatus manufactured by the Jackson Electric Stove Co., Ltd., which supplied an island electric cooking range comprising four ovens, over which are mounted hobs containing heavy-duty electric boiling plates and a grill. The boiling plates include two 5 kW plates, eight 2.5 kW plates and a grill with a loading of 3.75 kW. The total loading of the range is 52 kW. The company also supplied a steaming oven having a load of 5.1 kW and three electrically heated hot cupboards, with loadings of 4 kW, 5.1 kW and 9.2 kW. The whole of this equipment is in de luxe all-enamelled finish.

The total cooking load of the kitchen equipment is about 150 kW, electricity being taken from the mains of the West Ham Corporation Electricity Department.

In the main hall the lighting is obtained from twenty-four spherical pendant fittings of low-absorption white opal glassware housing 200-W "Osram" lamps. Messrs. Troughton & Young carried out the whole of the electrical installation under the supervision of the works chief engineer, Mr. D. A. Hackett, A.M.I.E.E.



The electric cooking equipment at the works canteen of Messrs. John Knight, Ltd., showing (left) the Jackson island electric cooking range, and (right) "Magnet" fish fryer and roasting oven

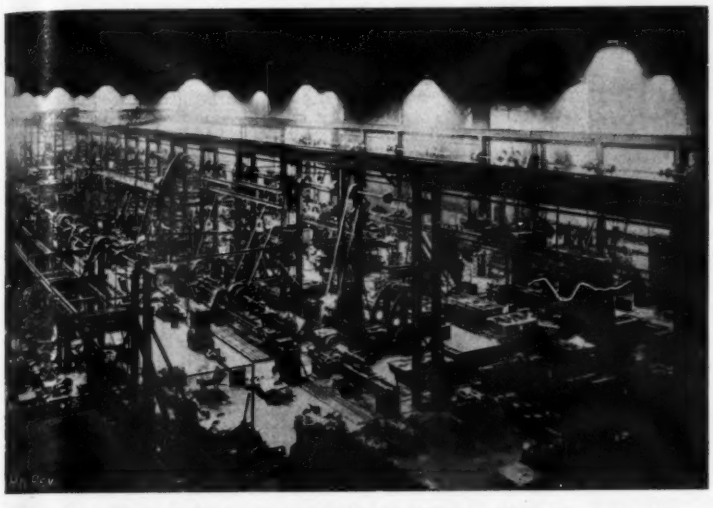
Electricity Supply

Lighting, Domestic, Power

Accrington.—NEW SWITCHGEAR.—The Electricity Committee is to provide new switchgear in its sub-stations at a cost of £7,512.

Ashton-under-Lyne.—CHANGE-OVER.—The Town Council has received sanction to a loan of £8,313 for the change-over in the East End district of the borough.

Australia.—POWER STATION EXTENSIONS.—In 1928 the Victoria Electricity Commission decided to extend its Yallourn power station by stages, installing three 25,000-kW generating sets and ten boilers as required. The first generating set and four boilers have been in operation for some time, and the second set was brought into service on August 1st last. Tenders are now invited for additional boiler plant, to operate at 650 lb. per sq. in. and 900 deg. F. It was originally anticipated that the ten boilers would supply steam for only 75,000 kW of generating plant, but with advances in design and the technique of operation it is now found that a much greater generating capacity can be served. Accordingiy, the Comission has decided to extend the generating plant by a further 25,000 kW when required. Thus the total capacity of the new extensions will ultimately be 100,000 kW instead of 75,000 kW. This increase of capacity will be obtained for an increase in total cost of only £63,000 over the original estimate of £2,200,000. The third set will probably be installed by 1937, and the fourth will deal with requirements up to 1941.—*Australian Electrical Engineer and Merchandiser.*



The machine shop of Messrs. Broom & Wade's factory, High Wycombe, illuminated by "Mazda Merera" lamps in B.T.H. indoor dispersive industrial fittings

Austria.—PRODUCTION OF ELECTRICITY.—Official statistics show that electric power generated by Austrian water-power and fuel-burning plants increased by 154,000,000 kWh between 1932 and 1934. Although hydrological conditions were unfavourable during the period, water-power generation accounted for the greater part of this higher output. The total energy produced in 1934 amounted to 2.3 milliard kWh, or 350 kWh per head of the population. The demand was not equally good all over the country. In Vienna, for instance, it declined from 502 million kWh in 1932 to 461 million in 1934. On the other hand, in the western part of Austria the figure rose from 256 to 314 million kWh during the same period. Considerable improvements have been made in the transmission and distribution system during the past two years. The length of the h.v. lines has increased by 944 km. and the l.v. lines by over 1,500 km.—*Financial Times.*

Bedford.—INTENSIVE DEVELOPMENT.—Twenty-one per cent. (or 7,143,000 kWh) more electricity was sold to consumers by the municipal undertaking during 1934-35 than in the previous year, but, due to cessation of the bulk supply to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co. owing to grid operation, the total sales fell by 7,756,000 to 40,906,000 kWh. Mr. R. W. L. Phillips, the borough electrical engineer, states in his annual report that 1,646 additional consumers were connected during the year, and from statistics extracted at December 31st last 76 per cent. of the premises to which a supply was available were connected to the mains. Lighting and domestic sales in connection with the rural demonstration scheme showed an advance of 37 per cent., while farms took 51,410 kWh more than in the previous year (19.2 per cent.). Due to intensive development of the brickfields in the area the amount of energy sold for industrial purposes in the rural area rose by 2,003,000 kWh (72 per cent.). The net result of the year's working of the undertaking was a deficit of £16,638. Mr. Phillips recalls that an effort was made to improve results by increasing the charges, but the consumers threatened to discontinue taking supplies, and it became necessary that the increased charges should be modified.

Bournemouth.—DECORATIVE LIGHTING.—Last week we illustrated a novel arrangement of decorative lighting on the lamp standards at Undercliff Drive. We are informed that these illuminations were carried out with the aid of "Beeantee" strip lighting.

Bristol.—HOSPITAL TO GENERATE ITS OWN ELECTRICITY.—As there will be a continuous supply of steam available at the new Barrow Hospital, it has been decided that it will be more economical to generate electricity at the institution instead of taking a public supply. The price of the necessary plant is estimated at £2,000. The Hospital Committee expects to save £400 a year.

Broadwindsor (Dorset).—SUPPLY INAUGURATED.—An electricity supply was made available to the village on November 7th, the switching-on ceremony being performed by Lady Pinney.

Clitheroe.—WAYLEAVES.—Arrangements have been made by the Corporation regarding wayleaves in connection with the proposed overhead supply to Newton. It is also intended to continue the lines to Slaidburn.

Dorchester.—STRIP LIGHTING ON HIRE.—The Electricity Committee is offering strip lighting on hire terms of 10s. per 100 yd. The work of fixing and removal must be undertaken by qualified persons under departmental supervision.

Epsom and Ewell.—ELECTRICITY UNDERTAKING FINANCE.—In his observations on the accounts of the electricity undertaking for 1934-35 the treasurer to the Council states that the results may be regarded as very satisfactory, the surplus having been increased by £1,201. He considers it distinctly creditable that the average price per kWh sold for all purposes was reduced from 2d. in 1930-31 to 1.6d. in the past year.

France.—HYDRO-ELECTRIC DEVELOPMENT.—*La Houille Blanche* recently published details of the new hydro-electric power station which has recently been established in France on the banks of the River Arn to utilise the power of the Vintrou falls. It was necessary to construct a dam to provide a large-storage reservoir, a water tunnel nearly two miles long, and a 3,936-ft. penstock. The plant at the power station, which works under a head of about 820 ft., comprises three 14,500-h.p. Francis-type spiral turbines coupled to alternators generating at 50 cycles, 11,000 V.

Gravesend.—STREET-LIGHTING IMPROVEMENTS.—The street lighting is to be modernised by the Electricity Committee at a cost of £17,430.

LOWER SUMMER CHARGES.—To encourage an extended use of electricity during the summer quarters the Electricity Committee recommends that the "unit" charge under the ordinary fixed-charge tariff shall be reduced to ¼d. and that under the domestic tariff to ¼d. during the quarters ending June 30th and September 30th.

Guildford.—CHEAPER ELECTRICITY.—A recommendation of the Electricity Committee provides for the "unit" charge under the "all-in" domestic rate to be reduced to ¼d. in the town and ¼d. in the rural area. Reductions are also proposed in respect of the business tariff, and the rural lighting rate is to be 5d./3d. instead of 5½d./4d. per kWh.

Halifax.—A PROGRESSIVE YEAR.—Mr. G. A. Vowles, the borough electrical engineer and manager, in his annual report on the working of the electricity undertaking during the year ended March 31st last, states that 2,350 new consumers were connected, making the total at the end of the year 16,886, the maximum demand increasing by 660 kW (4.2 per cent.). Eight per cent. more electricity was sold, there being an increase of 24 per cent. in domestic supplies, which amounted to 12,569,000 kWh. Traction sales (5,125,892 kWh) were 23.7 per cent. less. The hire department reports considerable progress. Altogether 1,120 cookers were connected during the year (27.4 per cent. increase), 616 wash-boilers (36 per cent.), and 387 water heaters (70 per cent.). The electricity sold per head of the population was 454 kWh, an increase of 8.3 per cent.

Hull.—MAINS AND SERVICES.—The Electricity Committee is to borrow £75,000 for mains and services.

ELECTRICITY REPLACES GAS.—The Works Committee is to substitute electric for gas lighting in the Poulevard.

Lincoln.—LOANS.—The City Council is to apply to the Electricity Commissioners for permission to borrow £30,000 for unspecified works in connection with mains and services in the city and £20,000 for assisted wiring.

Lincolnshire.—RURAL DISTRIBUTION.—Work is proceeding on the erection, by British Insulated Cables, Ltd., of about eighteen miles of 11-kV lines, together with the necessary distribution networks, for making the supply of the Boston and District Electric Supply Co., Ltd., available in the parishes

of Fishtoft, Freiston, Butterwick, Benington, Old Leake, Wrangle, and Wrangle Lowgate, which are in the area of the Boston and District Electric Supply Co., Ltd. The 11-kV lines are of cadmium copper (0.05 sq. in. copper equivalent) on wooden poles, with spans averaging 400 ft. The l.v. lines are 0.05 sq. in. hard-drawn copper on wooden poles, three-phase, four-wire distribution being employed in villages and single-phase, three-wire in hamlets. The usual vertical formation has been adopted for the distribution lines, but where crossing under Post Office lines three p.b.j. line wires and bare

L.v. poles at Wrangle, showing how lateral clearance is obtained

neutral are arranged horizontally. The 11-kV lines are sectionalised at various points with remote-controlled air-break switches. Pole-type transformers are used throughout.

London.—BATTERSEA.—Following the lead of several other undertakings in the London area, notably West Ham, Willesden and Poplar, the Electricity Department is introducing a domestic tariff of 1d. per kWh for all electricity consumed, payable through a prepayment meter, on condition that an electric cooker is used. The charge includes the rental of the cooker, the only other payment being 5s. for the initial fixing. It is necessary for consumers to adopt the tariff for a period of at least one year and to guarantee a minimum consumption at the rate of 1,200 kWh per annum. Where the tariff is adopted in connection with a rental wiring installation the charge is 1½d. per kWh for the first 1,200 kWh per annum, and 1d. per kWh thereafter.

Maidstone.—MAINS EXTENSIONS.—A number of extensions are to be carried out by the Electricity Department, including a h.v. main to a new admission block at the Barming Mental Hospital.

Margate.—RENEWED LEASE.—The Town Council has provisionally decided to grant a renewal of the lease of the Isle of Thanet Electric Supply Co., Ltd., for a period of thirty years, subject to certain conditions.

Newcastle-on-Tyne.—EXTENSIVE STREET-LIGHTING IMPROVEMENTS.—The Watch Committee proposes to proceed at once with its £12,865 scheme for improving the city's street-lighting system. Additional electric lamps are to be erected, while tramway standards are to be utilised for carrying electric-discharge lamps.

Newport (Mon).—LOWER CHARGES.—The Corporation has agreed to reduce the price of electricity from 2d. to 1½d. per kWh during the Decmeber quarter, mainly with the object of encouraging traders to give good Christmas window displays.

Northallerton.—EXTENSION OF SUPPLY.—A start is to be made shortly on the work of supplying electricity to North and South Cowton and Great Smeaton. The grid system has been carried to Moulton, and is to be extended by eight miles of 20,000-V overhead lines. The work will be carried out by the North-Eastern Electric Supply Co., Ltd.

Northumberland.—EXTENSION OF SUPPLY AREA.—The Scottish Southern Electric Supply Co., Ltd., of Edinburgh, has applied to the Electricity Commissioners for a Special Order to extend its area of supply for all public and private purposes to Norham and Islandshires, Branxton, Carham, Colkdsmouth, Thompson's Walls, Coupland, Crookhouse, Ford, Grey's Forest, Hethpool, Lanton, Howtel, Kilham, Kirknewton, Paston, Westnewton, and Yeavering, and a section of the parish of Lowick.

Norway.—A BIG SPAN.—An overhead line with a span of 3,680 metres has just been erected by the Tafjord Kraft Selskap over the Skareggen to Dryna, providing a free height of 60 metres over the sea level. It will supply power to Mioy and Sor-Aukra.

Nuneaton.—SODIUM LIGHTING.—The Corporation has had part of the main Coventry road as far as Griff lighted by sodium electric-discharge lamps.

Oxford.—STREET-LIGHTING TEST.—It is proposed to install electric-discharge lighting on a section of road outside the old city boundary so that the Highways, Sewers and Lighting Committee may compare the system with other illumination before proceeding with a £15,000 scheme for installing electric lighting in all the streets within the city.

Paisley.—MANY MORE ELECTRIC COOKERS IN USE.—Following an exhibition organised in November last year by Mr. J. E. Adams, the electrical engineer and manager, 1,000 additional electric cookers have been connected to the mains. Further stimulus to the campaign has just been provided by a series of cooking demonstrations arranged in conjunction with the General Electric Co., Ltd., and which, in three days, resulted in another 360 people applying for cookers to be installed. This progress has been encouraged by the institution of an all-in tariff of 1d. per kWh for electricity for all domestic purposes, including the free installation of the cooker, with no hire charge, together with an electric kettle and a radiator. Some idea of the extent of electrical development in Paisley is conveyed by the fact that during the past five years the number of consumers has grown from 9,259 to 17,110, and the annual consumption from thirteen to forty-seven million kWh.

Plymouth.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £3,400.

Preston.—SUPPLY TO GREENHALGH.—Representatives of the Fylde Rural District Council and Preston Corporation have conferred regarding the provision of a supply of electricity to Greenhalgh. The Corporation has waived the 20 per cent. guarantee recommended by the Electricity Commissioners, but it is not prepared to do anything unless guarantees amounting to 15 per cent. annually on the capital costs are obtained. The Rural District Council has decided to make up the deficiency if support cannot be obtained from those who have not yet agreed to take supplies.

Sheffield.—NEW MAINS.—Sanction has been obtained by the Electricity Committee to a loan of £5,922 for laying mains on the Arbourthorpe and Beighton estates.

South Africa.—LIGHTNING AND OVERHEAD LINES.—To offset the effects of lightning certain modifications have been made to the transmission line of the Rand Water Board between Zwartkopjes and Zuurbekom, while protective apparatus has been installed in these stations. The annual report of the Board (chief engineer, Mr. M. Udwin) for the year ended March 31st last states that the full benefit of the improvements had not then been gauged, but indications of the effect of the alterations were the increased availability of the line and the halving of the cost of damage through atmospheric conditions.

Stoke-on-Trent.—CHANGE-OVER.—The Electricity Committee is to change over the supply to industrial consumers in the Reginald Street and Jenkins Street area, Burslem. The cost of replaceing consumers' apparatus is estimated at £1,000.

STREET LIGHTING.—Public lighting is to be provided on the Stanfield housing site at an estimated cost of £800.

LOAN.—Application is being made by the Electricity Committee for sanction to borrow £6,000 for the equipment of a sub-station in High Street, Burslem, and the provision of the necessary mains.

Stone (Staffs).—EXTENSION.—The Urban District Council is to give a supply of electricity to thirty-six houses to be erected at Oulton, subject to guarantees equivalent to 20 per cent. annually on the capital outlay.

Walsall.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains in the Cannock district at a cost of £1,500.

Western Australia.—The report on the State electricity undertaking for the year ended June 30th, 1935, shows that the revenue (£324,973) was £27,725 more than in the previous

(*Continued on page* 689)

Generation of Electricity in October

THE official returns rendered to the Electricity Commissioners show that 1,650 million kWh of electricity was generated by authorised undertakers in Great Britain during October as compared with the revised figure of 1,434 million kWh in the corresponding month of 1934, representing an increase of 216 million kWh, or 15.1 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was 27, the same as last year.

During the first ten months of 1935 up to the end of October the total amount of electricity generated by authorised undertakers was 13,877 million kWh, as compared with the revised figure of 12,309 million kWh for the corresponding period of 1934, representing an increase of 1,568 million kWh, or 12.7 per cent.

	1934. kWh. (millions).	1935. kWh. (millions).	Increase per cent.
January	1,536	1,714	11.6
February	1,343	1,478	10.0
March	1,391	1,507	8.3
April	1,188	1,330	11.9
May	1,125	1,326	17.9
June	1,049	1,147	9.3
July	1,042	1,216	16.7
August	1,059	1,189	12.3
September	1,142	1,320	15.6
October	1,434	1,650	15.1

year, while working expenses increased by £29,266 to £222,856. The net profit was £40,459 (£41,949). A considerable increase in consumption is recorded, the electricity sold amounting to 87,417,000 kWh as compared with 79,911,000 kWh in 1933-34. The maximum load rose by 1,000 kW to 22,000 kW, and in consequence an early start is being made on the installation of a 25,000-kW turbo-alternator, together with the necessary condensing plant, boiler-house equipment, switchgear, &c., at a cost of £525,000.

West Hoathly (Sussex).—INQUIRY.—As a result of an inquiry held recently into the application of the Weald Electricity Supply Co., Ltd., for wayleaves, it is understood that a satisfactory arrangement was arrived at to lay underground cables in certain instances, and it is anticipated that the supply will be made available at an early date.

Winchester.—CONTROL OF ELECTRICITY MATTERS.—By fifteen votes to six the City Council recently decided to amend its Standing Orders so as to resume full control of the electricity undertaking. Several years ago the Council's powers were delegated to the Electricity Committee.

Traction

Bexhill.—CORPORATION SUPPLY TO TRANSPORT COMPANY.—We are informed by Mr. C. A. Frost, the borough electrical engineer, that since October 21st last the trolley-buses of the Hastings & District Tramway Co., operating in Bexhill, have taken a supply from the Electricity Department's mains, through a 300 kW Hewittic rectifier.

Hull.—PROPOSED TROLLEY-BUS SERVICES.—The City Council has approved, in principle, the running of trolley-buses on certain tram routes in the city.

London.—REDUCING NOISE ON THE "UNDERGROUND."—We understand that the London Passenger Transport Board, in continuing its efforts to reduce noise on the Underground Railway, is carrying out experiments with welded rails between Leicester Square and Goodge Street stations.

NEW TROLLEY-BUSES PLANS.—Providing the necessary Parliamentary permission is forthcoming the London Passenger Transport Board is to run a trolley-bus service through High Holborn and Charterhouse Street in order to link up the Gray's Inn Road tram terminus with that in Farringdon Road. It is stated that the Board intends to convert part of the tram services between Central and North London to trolley-bus working, altogether fifty miles of route being involved.

Manchester.—TRANSPORT BILL.—The promotion of a Parliamentary Bill to authorise the Corporation to run trolley-buses in place of trams has been approved by the City Council by ninety-one votes to one.

Plymouth.—NO TROLLEY-BUSES YET.—Consideration by the Transport Committee of reports on the proposed conversion from trams to trolley-buses has been adjourned.

Rotherham.—SIX TROLLEY-BUSES REQUIRED.—Tenders for the supply of six trolley-buses, a 300-kW rectifier and a sub-station are to be obtained by the Transport Committee in connection with a trolley-vehicle service to Greasborough. The Committee is to notify the Yorkshire Traction Co., Ltd., of its intention to operate the Greasborough route by railless vehicles and to negotiate a further agreement with the company to operate the Barnsley portion of the route on the basis of the present agreement.

Russia.—NEW ELECTRIFIED LINE.—The electrified section of the Perm Railway from Tagil to Sverdlovsk has been completed. As a result of the electrification the carrying capacity of freight trains has been increased from 900 to 1,500 tons, and the speed from 20 to 32 km.p.h.—*Monthly Review* of the Moscow Narodny Bank, Ltd.

Stalybridge.—TRAMWAY ABANDONMENT.—The Corporation has received notice from the secretary of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board of the intention of the Board to abandon a length of tramway between the Butcher's Arms and the Town Hall.

Switzerland.—ELECTRIFYING A MOUNTAIN RAILWAY.—It is reported in the *Railway Gazette* that a special meeting of shareholders of the Pilatus Railway has authorised a scheme for electrifying the line, traffic on which has declined very seriously during the last few years. It is considered that electrification will be the means of attracting a larger number of passengers and also of increasing the capacity of the line and reducing working expenses. The railway, which was opened in 1889, has a maximum gradient of 48 per cent., and employs the Locher rack system.

Western Australia.—The annual report on the Government tramways and ferries in respect of the year ended June 30th, 1935, shows an increase of over £4,000 in the earnings, the total revenue amounting to £284,673. Working expenses (£15,085) were slightly higher, and the net profit was £5,725, as compared with £9,841. Nearly 31,000 additional passengers were carried, the total for the year being 29,923,000. The trolley-bus service operated satisfactorily; 94,456 miles were run at a power consumption of 2.27 kWh per bus-mile. The passengers carried totalled 735,215 for a revenue of £6,831, and after paying working expenses (£5,925) and interest and depreciation there was a working loss of £1,385. At the end of June there was the equivalent of about eight miles of overhead lines for trolley-buses and fifty-seven miles for the tramways.

York.—TRAMWAY ABANDONMENT.—The last tram service will cease working to-morrow (Saturday) night, the transport system having been converted to motor-bus operation.

Communications

Elstree.—AN AUTOMATIC EXCHANGE.—In consequence of the expansion of the film industry in the neighbourhood the manual telephone system is to be discontinued and a new automatic exchange installed at Boreham Wood.

Great Britain.—RADIO LICENCES.—During October 959,365 radio licences were issued by the Post Office, the number in force at the end of the month being 7,274,482 as compared with 6,550,094 a year ago.

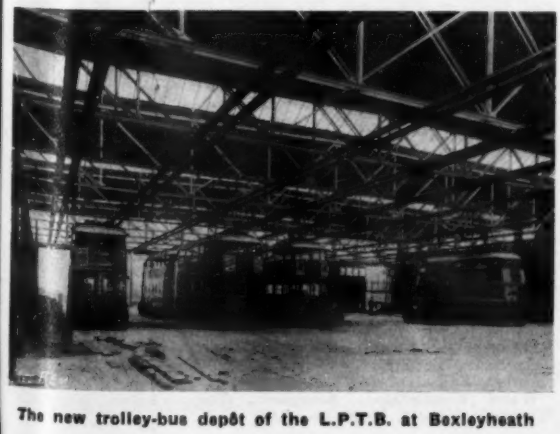
Irish Free State.—RECONSTRUCTION OF A WIRELESS STATION.—The wireless station on Valentia Island, off Kerry coast, has been completely reconstructed internally and new instruments, machinery, and other requirements, have been installed. The spark system has been discontinued.

United States.—RADIO COMMUNICATION WITH ETHIOPIA.—The United States naval engineers at Addis Ababa have successfully established direct wireless communication with the United States, states *Reuter* from Washington. The first message from the Chargé d'Affaires in the Ethiopian capital expressed gratitude at the establishment of the service.

A CREWLESS LIGHTSHIP EXPERIMENT.—Eight miles off the Michigan coast is stationed a ship without a crew which performs the function of warning mariners of nearby danger. The various signal devices, including a radio beacon, are controlled from a lighthouse on the shore. The lightship has been operating for several months in an experiment which will continue until Lake St. Clair, which separates Lake Erie from Lake Huron, is closed to traffic by ice. There will be at least another year of experimentation before it is decided whether to provide other such ships along the coasts.—*Telegraph and Telephone Age.*

Another London Trolley-bus Service

A FURTHER stage of the scheme of the London Passenger Transport Board for converting certain sections of its tram services to trolley-bus working was put into operation on Sunday last. The route affected is from Woolwich *via* Abbey Wood, Belvedere, Erith and Barnehurst to Bexleyheath over a distance of 8¼ miles. For the first time a through service has been provided from Woolwich to Erith and Bexleyheath. On November 24th the route from Woolwich *via* Plumstead, Welling and Bexleyheath to Dartford will also be converted. The change has required additional overhead wires, a new depôt and three sub-stations.



The new trolley-bus depôt of the L.P.T.B. at Bexleyheath

A fleet of thirty-eight trolley-buses, each seating sixty passengers, will operate the new service. The bodies have been built by the Brush Electrical Engineering Co., Ltd., on chassis made by Leylands, Ltd., with electrical equipment supplied by the Metropolitan-Vickers Electrical Co., Ltd. A new and important development is the provision of batteries which will enable the trolley-buses to be driven independently of the overhead wires for short distances should circumstances make such a movement necessary.

The new depôt is the first to be built specially for trolley-bus operation in Greater London. It has a floor space of 36,670 sq. ft. with offices, messrooms, canteen, billiard room, &c., on two floors. An open space at the back of the depôt is used for turning vehicles after they have passed from the repair shops or washing and cleansing plants. These latter are installed on the north side of the depôt, and the inspection pits, which are fitted with the latest equipment including recessed floodlights, are installed in the north-east corner beyond the repair shops. The depôt provides accommodation for sixty trolley-buses.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—SYDNEY.—December 9th. Electricity Department. 33,000-V and 11,000-V metal-clad switchgear for the Camperdown sub-station. (T.Y. 10183.)*

MELBOURNE.—January 13th. Electric Supply Committee. 6,600-V and 22,000-V switchgear for the Waratah Place sub-station. (T.Y. 10215)* (T.Y. 10214.)*

January 15th. Victoria Railways Commission. R.i. taped and braided copper conductors. (T.Y. 10212.)*

Barking.—December 3rd. Electricity Department. L.p., p.i. cables. (See this issue.)

Birkenhead.—November 18th. Electricity Department. E.h.p. and l.p. cable, meters and lamps. (November 8th.)

Birmingham.—November 27th. Electric Supply Department. Stoneware conduits for electric cables. (November 8th.)

Brighton.—November 20th. Electricity Department. Gas-filled electric lamps for street lighting. (November 8th.)

Cardiff.—November 19th. Electricity Department. L.p. cables. (November 8th.)

Industrial Development Council of Wales and Monmouthshire. Installation and maintenance of temporary electric lighting of the stands at the Welsh Industries Fair, Spring 1936. D. J. Davies, secretary, 17, Windsor Place.

Colwyn Bay.—November 23rd. Electricity Department. H.p. and l.p. switchgear. (November 1st.)

Egypt.—CAIRO.—January 4th. Mechanical and Electrical Department, Ministry of Public Works. 150-kW Diesel generating set and accessories for the Government Press. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, S.W.1 (deposit £1 0s. 6d., not returnable).

December 18th. Ministry of Public Works. One Diesel-driven 5-kW d.c. generating set, complete with switchboard, &c., for the Nubian floating workshop. (T.Y. 10210.)*

December 23rd. Electrically driven lathe and slotting machine for Atf power station. (T.Y. 5464.)*

Fife.—November 16th. County Council. Various works, including electric lighting, at additions to Oakfield Higher Grade School, Kelty. G. Sandilands, county master of works, Education Offices, Kirkcaldy (deposit £1 1s.).

Fleetwood.—Electricity Department. Two 10/12 cwt. electric vans. (See this issue.)

Glasgow.—November 21st. Corporation. Electrical installations at Possil Road housing scheme. Town Clerk's office (Room 36).

Haddington.—November 30th. Electrical work and additions to Vent Memorial Hospital. J. Douglas Miller, architect, 5, Forres Street, Edinburgh (deposit £2 2s.).

Hendon.—November 25th. Town Council. Filtration plant, chemical apparatus, pipings, valves, direct-coupled motors and pumps, and electrical equipment, control gear and wiring, &c., at the open-air swimming pool, West Hendon. A. O. Knight, borough engineer, Town Hall (deposit £2 2s.).

Hoylake.—November 23rd. Water Department. Diesel-driven alternator. Water engineer, Town Hall.

Iran.—Ministry of Posts, Telegraphs and Telephones. Lamps for the central "Pahlévi" wireless station, Teheran. Commercial Attaché to the Imperial Iranian Legation, Ling House, 10-13, South Street, London, E.C.2.

Irish Free State.—DUBLIN.—November 16th. Great Northern Railway (Ireland). Supply of stores, including electrical fittings, train lighting, cell parts, omnibus batteries and fittings, lamps, &c., for twelve months from January 1st, 1936. Forms of tender (1s. each) from the Secretary, Amiens Street Station.

November 18th. Dublin United Tramways Co. (1896), Ltd. Supply of general stores, including trolley car and electrical fittings, lamps and cables, for twelve months ending December 31st, 1936. Forms of tender (2s. 6d. each) from the Secretary, 59, Upper O'Connell Street.

Keighley.—Contractors wishing to tender for the electrical work in connection with the erection of a nurses' home at the Keighley and District Victoria Hospital should communicate with W. Harold Watson, Barstow Square and King Street, Wakefield.

Kettering.—November 29th. Electricity Department. Two 1,000-kVA transformers and one e.h.p. switchboard. (See this issue.)

London.—CENTRAL ELECTRICITY BOARD.—December 9th. 66-kV overhead transmission lines for the North-West England and North Wales Electricity Scheme. (November 1st.)

Louth.—November 26th. Electricity department. L.p., p.i cables. (See this issue.)

Manchester.—November 20th. Electricity Department. Twelve months' supply of electric water heaters. (November 8th.)

November 29th. Three-phase, 4-wire, 400/230-V a.c. switchgear. (November 8th.)

New Zealand.—WELLINGTON.—December 17th. Public Works Department. Three 150-kVA oil-immersed transformers. (T.Y. 10197.)*

Oldham.—November 18th. Electricity Committee. E.h.p. cable. (November 8th.)

Plymouth.—December 7th. Corporation. 33,000-V switchgear, 33,000/6,600-V transformers, and auxiliary apparatus. (November 8th.)

Portsmouth.—Electricity Department. E.h.p. cables (underwater and underground) between the generating station, Portsmouth, and Gosport. (See this issue.)

Rothesay.—November 28th. Electricity Department. 500-kW Diesel oil engine generating set. (November 8th.)

Southampton.—November 19th. Electricity Department. One vertical band-type, self-cleaning, motor-driven circulating water screen to deal with 1½ million gal. of water per hour. W. G. Turner, borough electrical engineer, Civic Centre (deposit £1 1s.).

November 26th. Storage battery with metal rectifier chargers, control panel, &c. (See this issue.)

Sunderland.—November 26th. Town Council. Two electric bed lifts for the Municipal Hospital. Borough engineer, Town Hall (deposit £2 2s.).

Wembley.—November 30th. U.D.C. Carcase wiring for 86 cottages on Manor Farm housing estate. (November 8th.)

West Ham.—November 25th. Electricity Department. Paper-insulated cables and coal. (November 1st.)

West Riding.—November 25th. County Council. L.p. hot water apparatus and electric lighting in the following schools: Goole New Senior C., Knaresborough C., Ryhill and South Hiendley New Senior C., and Stainforth New Senior C. Education officer, County Hall, Wakefield.

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Accrington.—Electricity Committee. Recommended. Switchgear.—A. Reyrolle & Co., Ltd.; G. Ellison, Ltd.

Dalbeattie.—Town Council. Accepted. Electrical work at housing scheme (£125).—R. Dunn & Son.

Dover.—Town Council. Accepted. Equipment for transformer chambers at Hawkesbury Street, Pencester Road and the Town Hall (£2,610).—Crompton Parkinson, Ltd. This was the lowest of thirteen tenders, the highest being £4,226.

Durham.—County Education Committee. Accepted. Electrical installation in schools: Preston-on-Tees (£75) and Dunston (£255).—Reid Ferens & Co. Lanchester (£205).—J. Mayo.

County Council. Accepted. Twelve months' supply of electric lamps.—Omega Lampworks, Ltd.

Eccles.—Housing Committee. Accepted. Electric lighting installation in eighty Council houses (£371).—G. Tooth & Sons.

Folkestone.—Town Council. Accepted. Wiring houses in Hill Road (£166).—Grensells (Wellingborough).

Hull.—Health Committee. Accepted. Electric truck (£213).—Greenwood & Batley, Ltd.

Kirkcaldy.—Town Council. Accepted. Switchgear (£4,188).—A. Reyrolle & Co., Ltd.

London.—L.C.C. Accepted. Electric lighting and heating at Central school and Millfields Road school, Hackney (£949).—Henfrey Electrical Installations, Ltd.

Fire Brigade and Main Drainage Committee. Accepted. Wiring and fittings for electric lighting in staff quarters at certain fire stations (£640).—City Electrical Co. Four sets of ten electrically driven paddles for four aeration channel units, improvement to two existing sets of paddles and transfer and setting to work of one existing set of paddles for a fifth aeration channel unit at the Northern outfall works (£15,142).—Hartleys (Stoke-on-Trent), Ltd.

Hospitals and Medical Services Committee. Accepted during the six months ended September 30th, 1935.—Electrical installations in hospitals and institutions: Clinical laboratories and temporary common room at British Post-graduate Medical School, Hammersmith Hospital (£562) and St. George-in-the-East Hospital, Wapping (£963).—T. Clarke & Co., Ltd. Constance Road Institution, Block E (£690).—Wiring, Ltd. Hammersmith Hospital, Ward Block D (South) (£1,575).—G. E. Taylor & Co. Lambeth Hospital (£2,623) and Queen Mary's Hospital for Children, Carshalton (£728).—A. Meckhonik. Mile End Hospital (£954) and new nurses' home, &c., at Pinewood Sanatorium, Wokingham (£522).—Read & Partners, Ltd. Nurses' home and staff quarters at St. Charles' Hospital, Ladbroke Grove (£2,124) and Pavilion G.H., St. Charles' Hospital (£692).—Samuel Reed & Sons. St. Peter's Hospital, Whitechapel, Wards A, D and E (£838).—A. Cozens. Nurses' home extension at St. Stephen's Hospital, Chelsea (£795).—F. G. Edey & Co., Ltd. Staff and isolation blocks at South-Western Hospital, Stockwell (£925).—A. Hawkins & Sons. Electric fire-alarm system at Hackney Hospital (£895).—Samuel Reed & Sons. Rewiring St. Margaret's Hospital, Kentish Town (£827).—Pinching & Walton. Electrical apparatus at St. Mary, Islington, Hospital (£1,469) and new receiving block, &c., at St. Stephen's Hospital, Chelsea (£743).—W. J. Furze & Co. (London), Ltd. Wireless equipment at hospitals.—Malcolm & Allan (London), Ltd. (£1,490); G. E. Taylor & Co. (£2,672). Electric lifts at various hospitals and institutions: Evans Lifts, Ltd. (Five—£3,882); Etchells, Congdon & Muir, Ltd. (Three—£1,605); Express Lift Co., Ltd. (Six—£4,635); Bennie Lifts, Ltd. (Two—£1,195).

Manchester.—Education Committee. Accepted. Electrical installation at Yew Tree school.—R. Seddon & Sons (Manchester), Ltd.

Water Committee. Accepted. Two electric winches.—Wharton Crane & Hoist Co., Ltd.

Northumberland.—County Council. Accepted. Renewal of electric storage batteries at the Wooley Sanatorium (£365).—Tudor Accumulator Co., Ltd.

Plymouth.—Electricity Committee. Accepted. Two-part tariff prepayment meters.—Ferranti, Ltd. Motor-generator set (£116).—Veritys, Ltd.

Sheffield.—Education Committee. Accepted. Electrical installation at Woodthorpe school (£628).—T. B. & W. Cockayne, Ltd.

Electricity Committee. Accepted. Sub-station switchgear (£784).—A. Reyrolle & Co., Ltd. Five 450-kVA transformers (£369).—Electric Construction Co., Ltd.

Scarborough.—Town Council. Accepted. Electric lighting of the South Foreshore Road and Ramshill Road public conveniences and part of the Corporation Depôt, Dean Road.—J. G. Appleyard.

Forthcoming Events

Association of Consulting Engineers.—Friday, November 15th. St. Stephen's Club, S.W.1. 7 for 7.30 p.m. Dinner.

Electrical Trades' Commercial Travellers' Association.—Friday, November 15th. Criterion Restaurant, W.1. 6.30 for 7 p.m. Annual dinner-dance.

Midland Electrical Engineers' Ball.—Friday, November 15th. Grand Hotel, Birmingham.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, November 16th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Arc Welding Equipment for Collieries." Messrs. A. T. Robertson and E. B. Nixon.

Electrical Power Engineers' Association (*London Technical Group*).—Monday, November 18th. Caxton Hall, S.W.1. 7.15 p.m. "Control by Photo-Electric Cells." Mr. E. W. Forster.

Association of Supervising Electrical Engineers.—Tuesday, November 19th. E.L.M.A. Lighting Service Bureau, W.C.2. 7.15 p.m. "The High Rupturing Capacity Fuse and Its Applications." Messrs. A. M. Pooley and H. Simmonds.

Diesel Engine Users' Association.—Wednesday, November 20th. Caxton Hall, S.W.1. 3 p.m. Informal discussion on "Modern Methods of Indicating High-Speed Engines."

Institution of Electrical Engineers.—Thursday, November 21st. Institution, London. 6 p.m. "Standardisation of Impulse-Voltage Testing." Messrs. T. E. Allibone and F. R. Perry. (*Dundee Sub-Centre*).—Friday, November 15th. University College, Dundee. 7.30 p.m. "The Laws Concerning the Cooling of Electrical Machinery by Fluids." Mr. R. Royds. (*London Students' Section*).—Friday, November 15th. White Horse Hotel, W.C.1. 7.30 for 8 p.m. Smoking concert. Saturday, November 16th. 2.30 p.m. Visit to Charrington's Brewery, E.1. (*Meter and Instrument Section*).—Friday, November 15th. Pagani's Restaurant, W.1. 6.45 for 7 p.m. Annual dinner and reunion. (*North-Eastern Students' Section*).—Friday, November 15th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Impromptu speech night. Friday, November 22nd. Tilley's Grand Assembly Rooms, Newcastle-upon-Tyne. 8 p.m. Annual dance. Saturday, November 23rd. 3.30 p.m. Joint visit with the Graduates of the North-East Coast Institution of Engineers and Shipbuilders to the I.C.I. Works, Billingham-on-Tees. (*Mersey and North Wales (Liverpool) Centre*).—Monday, November 18th. The University, Liverpool. 7 p.m. "Television: Its Physical Basis and Advance." Mr. J. J. Denton. (*North-Eastern Centre*).—Monday, November 18th. Rendezvous Restaurant, Newcastle-upon-Tyne. 7 p.m. Informal discussion on "Safety in Consumers' Low-Voltage Installations." To be opened by Messrs. E. Fawssett and H. Leyburn. (*South Midland Centre*).—Monday, November 18th. James Watt Memorial Institute, Birmingham. 7 p.m. "Equipment and Performance of Steel-Tank Rectifier Traction Sub-Stations Operating on the London Underground Railways." Mr. A. L. Lunn. (*Tees-Side Sub-Centre*).—Monday, November 18th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "The Effect of Legislation and Regulations upon Electricity Distribution." Mr. W. Fennell. (*North Midland Students' Section*).—Tuesday, November 19th. Hotel Metropole, Leeds. 7.15 p.m. "Low Tension Networks." Mr. B. H. Akers. Thursday, November 21st. 6 p.m. Visit to the Nox Electric Lamp Co., Hunslet. (*North-Western Centre*).—Tuesday, November 19th. Engineers' Club, Manchester. 7.15 p.m. Paper by Mr. A. L. Lunn. (*Scottish Students' Section*).—Tuesday, November 19th. Heriot Watt College, Edinburgh. 7.15 p.m. "Some Engineering Developments in Sweden." Mr. H. C. Stevenson. Thursday, November 21st. Royal Technical College, Glasgow. 7.30 p.m. Mr. H. C. Stevenson's paper. (*South Midland Students' Section*).—Tuesday, November 19th. James Watt Memorial Institute, Birmingham. 7 p.m. "High Power Switchgear Test Plants." Mr. J. S. Cliff. (*Sheffield Sub-Centre*).—Wednesday, November 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Recent Progress in Induction Motor Construction." Mr. L. H. A. Carr. (*Bristol Students' Section*).—Thursday, November 21st. Address by Mr. H. Manley Roberts. (*Irish Centre*).—Thursday, November 21st. Trinity College, Dublin. 6 p.m. Particulars to be announced later.

Batti-Wallahs' Society.—Thursday, November 21st. Hotel Metropole. 12.30 for 12.55. Luncheon to Sir Harry Renwick, Bt.

British Electrical & Allied Manufacturers' Association.—Thursday, November 21st. Connaught Rooms, W.C.2. 7 for 7.30 p.m. Annual dinner.

Makers' Names Wanted

RATHBONE steriliser.

LYNDON conduit.

TRIUMPH time-lag switches.

Notes

Yorkshire E.P.E.A. Dinner

The annual dinner, dance and cabaret, of the West Yorkshire Section of the Electrical Power Engineers' Association took place on November 8th at Leeds, when about 260 guests constituted a record attendance. Mr. J. F. Sarvent, chairman of the section and senior vice-president of the Association, presided. Proposing the toast of "The Association," Alderman R. Tortington, chairman of Leeds Electricity Committee and chairman of No. 2 Area District Joint Board, expressed appreciation of the work of the E.P.E.A. and its record of achievement. Mr. C. Cooper (Woolwich), president of the E.P.E.A., responded, and, referring to the work of the National Joint Board, said he did not believe that the supplementary schedule of salaries and wages would in any way increase the cost of electricity. The Association's Legal and Parliamentary Committee had never been busier than at present, and would have to keep a close watch on the Distribution Committee now sitting in London, a body likely to issue a report which might revolutionise the distribution side of the supply industry. The E.P.E.A. would have to see to it that members were protected against loss of their jobs, or allowed adequate compensation for displacement. The health of the ladies and guests was given by Mr. W. Dundas, deputy city electrical engineer. Bradford, and responded to by Mr. Neil McLean, borough electrical engineer of Harrogate. The chairman voiced thanks to the dinner sub-committee for its excellent work, and to Miss Muriel M. Clarke for her provision of the cabaret entertainment.

E.A.W. Activities

Owing to the rapidly increasing number of branches of the Electrical Association for Women and the greatly extended scope of their activities, it has recently become more and more necessary for branch officers to have an opportunity to meet and discuss their various developments and problems, and to receive advice and suggestions from headquarters. A branch officers' week-end conference has therefore been arranged at High Leigh, Hoddesdon, Herts, starting on Friday evening, November 22nd, with an informal reception by Councillor Mrs. Gregory, chairman of the Association, and members of the Executive Committee. After leaving High Leigh on Monday morning many of the delegates will attend the meeting of the Central Council of the Association at the London headquarters and the "at-home" to be given in the afternoon by the Executive Committee to delegates attending the course and members of the Council.

The inaugural meeting of the West Kent Branch (the fourth in the county) was held at Orpington on October 31st. The president of the branch, Lady Kemnal, was unable to be present through illness, and the chair was taken by Mrs. Pender Chalmers, vice-chairman of the Association. The speakers were Sir John Snell, chairman of the Electricity Commission, who spoke on electricity in rural areas; Miss C. Haslett, director of the E.A.W., who outlined the work and activities of the Association; and Mr. J. C. Dalton, manager and secretary of the County of London Electric Supply Co., Ltd., who stressed the way in which the E.A.W. helped the supply companies by the training of demonstrators. Mrs. Mortimer Hawkins outlined the future activities of the branch, and Sir Leonard Pearce thanked the speakers.

The Bolton Grid Connection

In our issue of October 11th, in describing the new switch-house and control room for connecting the Back o' th' Bank power station of Bolton Corporation to the grid, we referred to the extensive re-cabling necessary. The work was carried out by the staff of the Electricity Department and the cables were supplied by British Insulated Cables, Ltd. About 5,500 yd. of 0.75 sq. in. 6.6-kV single-core p.i. l.c. cables, served over the lead sheath with two hessian tapes and treated with fire-resisting compound, were carried on runways in the service basement under the new switch-house and through underground ducts into the old switch-house, where they rise vertically to racks on walls and ceilings. Twelve 6.6-kV three-core B.I. cables, installed between 1914 and 1919 as trunk feeders from the power station to three main sub-stations and laid under the site of the new switch-house, were diverted to run on racks on the side wall, involving the making of twelve straight-through joints.

The Ball—All Tickets Sold

Lord and Lady Iliffe have given their patronage to the Electrical Industries Benevolent Association Ball. We are pleased to hear that all the tickets—a total of 650—were sold three weeks in advance of the event (November 26th). The Social Committee of the Association wishes to express its appreciation of the co-operation received from advertisers in all sections of the industry.

An Improved 16 m.m. Cinema Projector

The capabilities of a 16 mm. cinematograph projector of unusual type were demonstrated at the Rialto Cinema Theatre last week by British Instructional Films, Ltd. The outfit is packed for portability in two carrying cases, one housing the projector and the other the amplifier and loud speaker, weighing together about 80 lb.

With a beam throw of 66 ft. on to a 10 ft. by 8 ft. screen, the results achieved, both pictorially and acoustically, were

in many respects comparable with those of a full-sized standard projector, while ample output volume was available for a theatre with a seating capacity of several hundred people.

Another exceptional feature is that this machine overcomes the problem associated with the use of films made on the D.I.N. (Continental) and S.M.P.E. (American) systems. The difference between them is mainly that one has the sound track on the left-hand side while the other has it on the right-hand side. This machine is so constructed that it can project either system with equal efficiency. This is achieved by providing two claws for moving the film through the gate, one on each side. Either can be selected at will according to the type of film in use by merely depressing the unwanted claw out of the way in its slot, which action causes the claw on the opposite side to project and engage with the perforations in the side of the film. Also the machine will project both silent and sound films, at the appropriate speed.

A single 750-W 110-V lamp is used for projection, part of its beam being directed on to the photo-electric cell, dispensing with the need for a separate exciting lamp. The projector is very well made, possessing several attractive features of design. It is of French origin (André Delbrie) and is being marketed in this country by British Instructional Films, Ltd., 103, Wardour Street, W.1.

R.A.F. Officers' Reunion Dinner

The officers of the Electrical and Wireless School of the R.A.F., Farnborough, Flowerdown and Cranwell, will hold their reunion dinner at the Royal Air Force Club, 128, Piccadilly, W.1, on January 11th, at 7 for 7.30 p.m. Owing to the death of Mr. J. F. Herd, addresses of many members have gone astray, but full details may be obtained from F./Lieut. F. S. Wainscot, Electrical and Wireless School, Royal Air Force, Cranwell, Lincs.

Electrode Boilers at a Paper Mill

The Follum Trasliperi of Follum, Norway, which is claimed to have the largest paper-making plant in the country, is obtaining electrical energy from the Nore hydro-electric works for feeding three vertical 17,500-kW electrode steam boilers, said to be the largest in Europe. The boilers are six metres high, two metres in diameter, and can work at 25 atmospheres. The current is transmitted at 132,000 V and is transformed to 5,500 V at the mill.

Mine Lighting

There were 620,447 safety lamps in use in mines on June 30th last, a net decrease of 17,872 since the previous year, and of 104,149 since June 30th, 1931. This total decrease corresponds approximately with the reduction in the number of persons employed below ground, but is a balance between relatively small increases in the number of electric lamps and large decreases in the number of flame lamps in use. There was an increase of electric lamps as compared with 1934 of 2,488 (from 395,418 to 397,906) made up mainly of an increase of 8,140 (from 32,572 to 40,712) in the number of cap-lamps and of a decrease of 5,499 (from 361,337 to 355,838) in the number of hand lamps.

Since 1931 there has been an increase of 10,655 in the total number of electric lamps, but, while the cap-lamps have increased by 19,106 (nearly 100 per cent.), the hand lamps have decreased by 8,768. Of the 40,712 cap-lamps now in use, Scotland has 25,006, representing 85 per cent. of all the electric lamps used in that coalfield; the proportions in the other coalfields are much lower. Except for Northumberland and Durham (14 per cent.) the proportion in the English coalfields is under 4 per cent., and in Wales cap-lamps are hardly used at all at present. Despite the general decrease in the number of hand lamps, the number of 4-V and 2.5-V hand lamps showed an increase, and now amounts to just over one-half of the electric hand lamps in use; last year the proportion was two-fifths. Speaking generally, it is only the cap-lamps and the 2.5-V and 4-V hand lamps which comply with the new standard of lighting performance set up by the Lighting Regulations, 1934, and the figures here recorded indicate the progress that is being made in complying with these Regulations, which come fully into force at the end of 1936.

Power Factor Correction

Much useful technical information on the improvement of power factor is given in a publication of the Dubilier Condenser Co. (1925), Ltd. The arguments in favour of the employment of condensers, backed by concrete examples of savings in cost, are clearly expressed, and methods of calculating the size of the units required for any degree of improvement are set out in detail. The latter include a table, curves and alignment charts that facilitate approximations for practical purposes.

Materials for Electrical Appliances

A new publication (A.A.8) in the series of "Recommended Materials for Electrical Appliances," has been issued by the Bureau of Information on Nickel and is obtainable free of cost from the Mond Nickel Co., Ltd. This covers domestic heating, cooking, and water heating, and industrial furnaces and ovens, rheostats, soldering irons and various miscellaneous appliances. There is also a section on lighting for both domestic and industrial purposes which includes arc lamps, neon signs and dimmers. Tables giving the recommended compositions of the different alloys are an essential part of the pamphlet.

Appointments Vacant

Engineers for commissions in the Royal Army Ordnance Corps as lieutenants.

Control engineer and clerk for Croydon Electricity Department.

Assistants; Grade II, at the Royal Aircraft Establishment, South Farnborough.

Junior assistant for Sleaford Electricity Department.

(See our classified advertisements.)

The Case for Railway Electrification

A BROCHURE just issued by the British Electrical Development Association (3d.) gives a clear and readable survey of "The Case for Electrification of the Railways." Brief particulars are given of the various completed projects from the City and South London tube in 1890 to the Manchester-Altrincham line in 1931 and the London scheme of this year.

The reluctance of railway companies to electrify was partly based on the absence of a general system of cheap supply of energy, but this has been removed by the 1935 Act which empowers the Central Electricity Board to supply direct to the railways. The Weir Report of 1931 stated that the Board would provide transmission lines and sub-stations, and would deliver d.c. to the railways at 0.5d. per kWh, the companies operating and maintaining the sub-stations. Subsequently the Board estimated the price at 0.475d. per kWh for 6,000 million kWh per annum for complete electrification in twenty years—a figure that compares favourably with that paid by the Swiss Federal Railways for electricity—from water power. (In Natal the price is, as we recently stated, 0.7d. per kWh for a 300-mile main line.)

The advantages of electric traction are given as: the almost unlimited power available for each train from a central power station, the ability of the electric motor to exert twice its normal power for short periods, the provision of adequate adhesive weight by articulated axles or multiple-unit drive with one crew only, independence of horse-power of loading gauge. These factors enable a higher acceleration to be obtained while the flexibility of the multiple-unit system allows the length of train to be varied to suit traffic density. The m.d. on the power station is about one-third of the aggregate m.d.'s of the trains.

In Chicago 10 per cent. of the atmospheric pollution is said to be due to steam locomotives, and in New York they have been banned from the centre of the city. The average cost of track conversion is about £2,500 per mile. Under electrification (*e.g.*, on the Southern Railway) towns that formerly had a few high-speed expresses and slow trains now enjoy a typical suburban service.

In Europe alone in 1934, plans were laid for the construction of over 6,200 miles of main-line electric railways and there is now some 20,000 miles electrified in other countries. Goods traffic can also be intensified by electrification, as the average speed is higher than with steam, especially on gradients, and a freight service can be sandwiched between passenger services more easily. Shunting in goods yards can be done satisfactorily by electric or oil-electric locomotives. The latter are very suitable for lightly loaded branch lines.

The present conditions are exceptionally favourable to conversion on a large scale as money is cheap, copper is abnormally low in price, and the iron and steel and constructional industries can accept contracts on more favourable terms than is likely in the future.

The main improvements in service that followed the Eastbourne and Hastings conversion on the Southern Railway are given in the following table:—

Services between	No. of electric services daily	Percentage increase over steam	Average time on journey	Average time saved	Percentage of time saved
			Hrs. Mins.	Minutes	
London & Eastbourne	22	29	1 27	14	13.86
London & Hastings via Lewes ...	21	50	1 59	16	11.85
London & Seaford ...	22	37	1 28	15	14.56
London & Bexhill Central	21	50	1 47	12	10.08
London & Lewes ...	24	20	1 6	9	12.00
Brighton & Seaford ...	44	68	34	13	27.66
Hastings & Brighton .	50	127	1 15	6	7.41
Brighton & Eastbourne	51	70	39	16	29.09

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

At the annual general meeting of the Junior Institution of Engineers (Inc.), held on November 8th, the following members were elected to hold office for the year:—Chairman, **Mr. A. E. Bingham,** A.M.I.Mech.E., A.M.I.Ae.E.; vice-chairmen, Messrs. H. G. Pusey, A.M.I.Mech.E., and A. P. Morris, Assoc. M.Inst.C.E., M.I.Struct.E.; hon. treasurer, Mr. W. M. Hurrell; hon. editor, Mr. C. E. Atkinson, M.I.E.E.; and hon. librarian, Mr. F. Squirrell. Messrs. W. M. Good, J. M. Storey, G. E. Lofts, M.Inst.F., and N. E. Pillinger, were elected members of the Council, and Messrs. J. Duguid, G. C. Sharman, E. E. L. How and S. R. Green, were appointed hon. auditors.

We are informed that **Mr. W. T. Sanderson** has relinquished his connection with Messrs. Space Heating, Ltd., of Leeds.

[*Jerome*

Mr. L. Newton Davey

Mr. L. Newton Davey has been appointed London manager for Messrs. J. H. Tucker & Co., Ltd., as from November 1st last. Mr. Davey received his training with Messrs. Siemens Bros. & Co., Ltd., of Woolwich, and has had a wide experience both practical and commercial of electrical engineering, including some years in India for the English Electric Co. He has relinquished the position of sales manager with the Kersons Manufacturing Co., Ltd., to take up his new appointment.

Mr. H. Roberts, who is in charge of the Colwyn Bay Electricity Showroom, has obtained a similar appointment with the Skipton Corporation.

Mr. D. Wallwork, president of the British Optical Association, on November 4th formally opened the "Science of Seeing" Exhibition arranged by the E.L.M.A. Lighting Service Bureau at Charing Cross Underground Station, reference to which was made in our issues of November 1st and 8th. He was accompanied by the secretary of the Association, Mr. J. H. Sutcliffe, and was welcomed by the chairman of E.L.M.A. Council, Mr. J. Y. Fletcher, and Mr. C. W. Sully, the Director of E.L.M.A. Mr. Wallwork complimented the

At the E.L.M.A. Exhibition at Charing Cross. (Left to right): Mr. J. Y. Fletcher, Mr. D. Wallwork, Mr. J. H. Sutcliffe, and Mr. C. W. Sully

Association on the display and said the public would learn a great deal about light-sight by visiting the exhibition.

It is announced that the following appointments of principal assistants to **Lt.-Col. T. P. Hobbins,** the North-Eastern regional director of the General Post Office, have been made:—**Mr. J. W. Atkinson,** deputy superintending engineer, London, is appointed deputy regional director. **Mr. C. A. Jackson,** North Midland District surveyor, is to be postal controller. **Mr. J. F. Murray,** district manager of telephones in the West Yorkshire District, has been appointed tele-communications controller. **Mr. F. G. C. Baldwin,** at present superintending engineer of the Northern Engineering District at Newcastle, becomes chief regional engineer.

Mr. F. Wood, chairman and managing director of the Vaughan Crane Co., Ltd., having completed fifty years' service with the company, was on November 7th presented with an ornamental cabinet on behalf of the directors, staff and employés, as a token of their respect and esteem. Mr. Wood has seen the rise of the company from infancy to its present position, and was one of the pioneers of the multi-motor overhead electric travelling crane.

Mr. J. H. Senior, of Doncaster, has retired from the telephone service after thirty-five years' work. He commenced in the Engineering Department of the National Telephone Co., and later was transferred to Doncaster in the Post Office Engineering Department.

Mr. W. Stewart, contracts engineer to the Macintosh Cable Co., and British Insulated Cables, Ltd., has been appointed mains superintendent to the Hazel Grove and Bramhall Urban District Council.

Mr. R. Levenger, son of Mr. M. Levenger, manager of the Wire Department of the General Electric Co., Ltd., has just sailed from England to take up an appointment on the staff of the B.G.E.C. at Sydney. Mr. Levenger was given a send-off at a farewell party, presided over by Mr. E. Joyce, and, as an appropriate mark of their affection, was presented by his colleagues at the head office of the company with an engraved silver tankard. Mr. Levenger was one of the leading members of the G.E.C. Dramatic Society.

Mr. W. Elsdon Dew, consulting electrical and mechanical engineer to the Central Mining & Investment Corporation, Johannesburg, has arrived in London, and until early in January his address will be c/o Central Mining & Investment Corporation, 1, London Wall, E.C.

We are pleased to learn that **Mr. Theodore Stretton,** managing director of the Concordia Electric Safety Lamp Co., Ltd., who underwent a severe internal operation in Cardiff last Sunday, is making fair progress.

Mr. M. J. Railing, vice-chairman and joint managing director of the General Electric Co., Ltd., was elected president for the coming year of the Electrical Trades' Commercial Travellers' Association at the annual meeting of the Association held on November 8th. **Mr. S. Johnson** (G.E.C.), was elected chairman of the Association, and **Mr. E. Herth** (Ozonair, Ltd.), vice-chairman.

Obituary

Mr. R. H. Schofield.—We regret to record that Mr. Robert Harry Schofield, for many years general sales manager, and latterly a director, of Ferranti, Ltd., died at his home, Kremston, Buxton, on November 7th at the age of fifty-three. That Mr. Schofield had been in poor health for several years was well known to his friends in the electrical industry, but it was only a few weeks ago that his illness became critical. It may sound remarkable that though he has left us at so early an age he had given forty years' service to the interests of the Ferranti business, but he joined the staff as an office boy in January, 1896, from which humble position he rose rapidly. His desire for technical knowledge gained him a transfer to the meter shops, and he pursued evening studies at the Oldham Technical College. He soon established a position for himself amongst meter engineers, and his leaning to the commercial side of engineering and his qualifications as a sales engineer led to his becoming chief salesman of the Ferranti meter department and subsequently head of all the company's sales activities. In this capacity he travelled extensively overseas. He had many friends in Canada and was a director of the Ferranti Canadian Company. Mr. Schofield became an associate member of the I.E.E. in 1912 and was elected a member of the Council in 1931. For twenty-five years he was closely connected with B.E.A.M.A. activities, being for the greater part of that time chairman of the Meter Section, of which, as the representative of Ferranti's, he was one of the original members. He represented that Association on many committees of the British Standards Institution and other bodies. Last year, through failing health already mentioned, Mr. Schofield retired from the active sales management of his company, and was

The late Mr. R. H. Schofield

appointed a director. The company has lost one of its oldest and most valued members and the staff a loyal friend and a respected chief. In expressing here our deep sympathy with his widow and family—two daughters and a son—we are voicing also the sentiments of a very large number of our readers in different parts of the industry.

The funeral service was held at Burbage Church, Buxton, on Saturday last. In addition to Mrs. Schofield and relatives, there were present Mr. and Mrs. V. Z. de Ferranti; Mr. D. Z. de Ferranti; Messrs. W. Tyldesley, J. W. Davies, C. W. Bridgen, J. Turner, O. M. Robson, C. P. Beardsall, F. Rostron, E. Grundy, E. T. Norris, C. A. Erlam, G. Reeve, A. Middleton, R. J. Hebbert, and other members of the Ferranti staff; Mr. P. D. Thomas, Mr. G. Henriques, Mr. and Mrs. W. Newton, Mr. Green and Mr. L. H. A. Carr, representing the I.E.E. The remains were cremated at Manchester on Saturday.

Mr. A. H. Kelsall.—The death occurred suddenly in Glasgow last week of Mr. A. H. Kelsall, of the Lancashire Dynamo Co. He received his early training with Messrs. Mather & Platt, Ltd., and joined the staff of the Lancashire Dynamo & Motor Co. when it was formed 37 years ago. Mr. Kelsall represented the company in Scotland from the year 1901. In 1913 the firm of Kelsall Parsons & Co., of Glasgow, was formed, and Mr. Kelsall's connection with the Lancashire Dynamo Co. continued down to his death. He became an A.M.I.E.E. in 1906. He was well known in Scottish engineering circles and will be much missed.

The late Mr. A. H. Kelsall

Mr. S. Hill.—Mr. Stafford Hill, A.M.I.E.E., mains engineer to the Stafford municipal undertaking, who had suffered from heart trouble for some time, and took to his bed five weeks ago, died on November 8th, aged 50 years. He joined the Stafford Electricity Department in 1921 as charge engineer at the generating station, and was transferred to the mains department in January, 1929.

Mr. C. J. Wharton.—The electrical industry has lost another of its pioneers by the death, which occurred on October 18th, of Mr. C. J. Wharton, O.B.E., M.I.E.E., aged seventy-eight years. There are still in harness many who knew his firm, Laing, Wharton & Down (now no longer in existence) which carried out a great deal of work in the early days of the application of electric power to industry. That firm at the outset was identified with the sale of Thomson-Houston apparatus in Great Britain, and in course of time became the original B.T.H. Co., of which company Mr. Wharton was the first chairman. Later he practised as a consulting engineer in Westminster, and with work at home and abroad maintained his contact with electrical matters until about a couple of years ago. He was a member of the Royal Corinthian Yacht Club and was actively associated with the Royal Naval Artillery Volunteers, who preceded the R.N.V.R. During the war Mr. Wharton was deputy-director of inspection of munitions areas. At the end of hostilities he formed, with others of the personnel who worked with him, the Technical Inspection Association which later, by charter, became the Institution of Engineering Inspection. Until a short time ago he was honorary secretary and treasurer of this Association.

The late Mr. C. J. Wharton

Mr. W. Hudson.—The death occurred suddenly on November 8th, at his home in Stalybridge, of Mr. William Hudson, special director of Messrs. Mather & Platt, Ltd., of Manchester.

Mr. J. A. Bower.—We regret to report the death of Mr. J. A. Bower, managing director of the Bower Engineering Works (Electrical & General), Ltd., of King William Street, London, which occurred suddenly at Bournemouth on November 11th. Mr. Bower had been actively engaged in electrical contracting interests in the City for between thirty and forty years.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Standard Rediffusion Services, Ltd.—Private company. Registered November 7th. Capital, £10,000 in 20,400 preferred ordinary and 19,600 ordinary shares of 5s. each. Objects: To establish and operate services for the relaying of radio programmes in London or elsewhere. The subscribers are: F. Medlicott, 1, New Square, Lincoln's Inn, W.C.2, and L. M. Messenger, 76, Rosemary Avenue, Finchley, N.3. Registered office: Bush House, Aldwych, W.C.2.

Hawnt & Co., Ltd.—Private company. Registered November 7th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical and radio wholesaler carried on by H. C. Hawnt, at 59, Moor Street, Birmingham, 4. The permanent directors are: Hubert C. Hawnt and Mrs. Beatrice J. Hawnt, both of "Byfield," Knowle, Warwickshire. Solicitor: L. C. Tilley, 63, Temple Row, Birmingham.

Multiplex (Kingston), Ltd.—Private company. Registered November 4th. Capital, £1,000 in 3,600 7 per cent. non-cumulative participating preference shares of 5s. each and 2,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and/or dealers in electric lamps of all kinds, &c. The subscribers are: E. P. Griffiths, 104, Priory Road, N.8, clerk; A. M. Barron, 54, Clarence Avenue, Ilford, Essex, secretary. Solicitors: Woodhouse & Co., Aldwych House, W.C.2. Registered office: 6, Weston Park, Kingston-on-Thames, Surrey.

Evenlite Tube Lamp Developments, Ltd.—Private company. Registered November 5th. Capital, £1,000 in 5s. shares. Objects: To carry on the business of manufacturers, buyers and sellers of all types of mechanical and electrical equipment, including incandescent filament lamps and gas-discharge tubes, electrical and mechanical engineers, &c. The directors are: P. Doyle, 504, Forest Road, Walthamstow, E.17; and C. C. Fowler, 207, Victoria Park Road, E.9.

Sitwell Products, Ltd.—Private company. Registered November 2nd. Capital, £1,000 in £1 shares (800 7 per cent. preference and 200 ordinary). Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, dynamo, accumulator and lamp manufacturers, &c. The directors are: P. A. Stilwell, Grosvenor House, Park Lane, W.1; and G. T. Harris, 199, Piccadilly, W.—Registered office: 29a, Charing Cross Road, W.C.2.

Southern Appliances, Ltd.—Private company. Registered October 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in sewing and washing machines, electric vacuum cleaners, &c. The permanent directors are: P. O. Davis (chairman), 33, Havelock Road, Croydon, Surrey, J. Williams, 11, Foxley Road, Thornton Heath, Surrey, and R. Couchman, 336, Lower Addiscombe Road, Croydon. Registered office: 33, Havelock Road, Croydon, Surrey.

Britannic Electric Cable & Construction Co., Ltd.—Private company. Registered November 8th. Capital, £100 in £1 shares. Objects: To carry on the business of contractors, manufacturers of electric cables and bitumen and waterproofing materials, electrical engineers, &c. The directors are: N. F. Badley, Graham Cottage, Iver, Bucks, and J. Connelly, 41, Bronwen Court, London, N.W.8.

Capaswitch, Ltd.—Private company. Registered November 8th. Capital, £2,000 in 2s. shares. Objects: To adopt an agreement with C. P. Stanworth, Stanolite Controls, Ltd., E. Dixon, G. T. Harris, W. F. Salmon and R. Hodge, to manufacture and sell an article patented under Patent No. 344445, and to carry on the business of electrical and radio engineers, manufacturers of and dealers in electric, magnetic, galvanic and mechanical apparatus, &c. The directors are: G. J. S. Chalmers, 6, Lloyds Avenue, London, E.C. (secretary), Capt. C. G. Lancaster (permanent director and chairman), and two others.

Returns of Electrical Companies

Z. Electric Lamp & Supplies Co., Ltd.—The nominal capital has been increased by the addition of £14,000 in £1 ordinary shares, beyond the registered capital of £26,000.

Paragon Electric Welding Co., Ltd.—A. J. Francis, of Allanton, Llandennis Road, Cardiff, ceased to act as receiver on November 2nd, 1935.

Ultra Electric, Ltd.—Capital, £200,000 in £1 shares. Return dated June 11th, 1935. 180,000 shares taken up. £48,000 paid, £132,000 considered as paid. Mortgages and charges, nil.

Revo Electric Co., Ltd.—Capital, £180,000 in 70,000 preference and 110,000 ordinary shares of £1. Return dated June 26th, 1935. 50,883 preference and 110,000 ordinary shares taken up. £157,528 4s. paid (£1 on 106,397 ordinary and 50,483 preference, 13s. 6d. on 494 ordinary, 5s. on 59 ordinary, and 15s. on 400

preference), £3,050 considered as paid on 3,050 ordinary shares. Mortgages and charges, nil.

Insulators, Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares beyond the registered capital of £5,000.

North-Eastern Electric Supply Co., Ltd.—Satisfaction to the extent of £500,000 on July 31st, 1935, of trust deed dated December 30th, 1933, and registered January 17th and March 1st, 1934. (Notice filed October 30th, 1935.)

Orion Lamps, Ltd.—Capital, £2,000 in £1 shares. Return dated October 24th, 1934 (filed June 12th, 1935). 1,245 shares taken up. £1,245 paid. Mortgages and charges, nil.

Weald Electricity Supply Co., Ltd.—Capital, £600,000 in £1 shares. Return dated March 26th (filed October 18th), 1935. 250,000 shares taken up. £246,000 paid. £4,000 considered as paid. Mortgages and charges, nil. A further 100,000 shares were allotted, payable in cash and fully called up on May 1st, 1935.

J. Segal, Ltd.—Capital, £2,000 in £1 shares. Return dated April 26th, 1935. 990 shares taken up. £10 paid. £980 considered as paid. Mortgages and charges, nil.

Escott Bros., Ltd.—Capital, £7,000 on 3,500 preference and 3,500 ordinary shares of £1. Return dated February 26th, 1935. 1,980 ordinary shares taken up. £1,980 paid. Mortgages and charges at date of return nil. Since registered (a) mortgage dated July 19th, 1935, to secure £700; (b) mortgage dated July 8th, 1935, to secure all moneys due to bank not exceeding £1,500. Returns of allotments, made up to July 8th, 1935, show a further 525 ordinary and 2,150 preference shares allotted, payable in cash and fully called up.

Boxer Radio Co., Ltd.—Capital, £550 in £1 shares. Return dated July 29th, 1935. 501 shares taken up. £453 10s. paid (£1 per share on 451 and 1s. per share on 50 shares). Mortgages and charges, nil.

Wirewell Electrical and Radio Installations, Ltd.—Charge on Wirewell Garage, Apsley Road, Walthamstow, dated October 29th, 1935, to secure £800. Holders: Westbourne Park Permanent Building Society.

Lane End Radio Service, Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £1,500. The additional capital is divided into 500 7½ per cent. cumulative preference and 500 ordinary shares of £1 each.

Rawlings Brothers, Ltd.—Capital, £100,000 in 30,000 preference and 70,000 ordinary shares of £1. Return dated July 26th, 1935. 21,903 preference and 61,401 ordinary shares taken up. £83,304 paid. Mortgages and charges, nil.

City Notes

Waste Heat & Gas Electrical Generating Stations, Ltd., proposes to reduce its capital from £350,000 to £190,000 by repaying 10s. per £1 share. The 30,000 unissued shares of £1 each are to be subdivided into two shares of 10s. The capital of the company will then be restored to the former amount of £350,000 by the creation of 320,000 10s. shares. In a circular to shareholders the company states that in view of the changes in the conditions affecting the electricity supply industry in the past few years, the directors consider that there may be less opportunity in the near future of utilising fully and profitably the liquid resources of the company. The payment received under the agreement with the North-Eastern Electric Supply Co. and the other cash resources of the company have been invested in gilt-edged securities and also in stocks and shares of power supply, gas, water and other concerns of a public utility nature. When this agreement terminates the company's income will, for the time being and until further opportunities for investment arise, be derived from its holding in the Galloway Water Power Co., in which it has a large interest, and in other electricity supply and gas undertakings as well as from investments of a general nature. In the circumstances the directors have come to the conclusion that it is in the best interests of the shareholders to return to them part of the subscribed capital. The proposals will be submitted at an extraordinary meeting to be held at Newcastle on November 29th.

The Cape Electric Tramways, Ltd., reports a profit for the year ended June 30th last, after debenture interest and depreciation, of £20,290 as compared with £23,045 for 1933-34. To this is added £56,731 brought in, making £77,021, and after various deductions there is a balance of £59,624. It is proposed to increase the dividend from 3½ per cent. to 4 per cent. The improved conditions referred to last year have been maintained. Traffic results in Cape Town are not strictly comparable with the preceding year owing to the expansion of the company's business through the acquisition of the Peninsula Transport Co. (Pty.), Ltd. During the year arrangements were completed for the creation of 4½ per cent. debentures to the amount of £275,000. The issue of £200,000 has been authorised and at June 30th last £167,400 had been allotted to meet present requirements. Capital expenditure during the year amounted to £13,410, of which £8,814 was used for the preliminary expenditure on the new railless trolley system. During the past year the tramways in Cape Town and Port Elizabeth carried 29,254,228 passengers, as against 28,445,421 in the previous year. These figures include passengers carried and revenue earned by the Peninsula Transport Co. (Pty.), Ltd., for 8½ months.

The Lightfoot Refrigeration Co., Ltd., reports a trading profit for 1934 of £33,160, as compared with £23,273 in the preceding year, and a net loss of £6,698 (against a net loss of £15,653). The total written off experimental and development expenditure and expenditure on "Ellarcold" machines was £5,116, and the debit at December 31st, 1933, was £45,281, making a debit of £59,094, less sale of "Ellarcold" patent rights in France (£1,000), leaving a debit at profit and loss of £58,094. During the current year arrangements have been completed as a result of which the cash position has been placed on a satisfactory basis, all outstanding loans have been repaid, a number of debentures redeemed and an ample reserve of working capital provided.

Electric & Musical Industries, Ltd.—According to the *Financial Times* British interests have received Treasury sanction for the repatriation of the bulk of the holding in this company owned by the Radio Corporation of America. It is understood that the shares in question have been acquired by two well-known finance houses in the City, and that they will be sold through market channels. The Corporation's holding in the British company at December 31st last was 1,700,000 ordinary 10s. shares and 1,000 preference £1 shares.

Yarrow & Co., Ltd., announce a net profit for the year ended June 30th last of £30,680, as compared with £37,032 for the preceding year. The dividend is to be maintained at 10 per cent., but the allocation to general reserve is to be reduced from £20,000 to £15,000, leaving £24,684 to be carried forward (against £24,005). The directors report that further orders for boilers of both marine and land types have kept that department well occupied during the year.

Drake & Gorham, Ltd., report that for the year ended June 30th last, after payment of interest on debenture stock and deducting the amount brought in, there is a balance of £592 to be carried forward. During the year £1,950 of 5½ per cent. debenture stock has been redeemed. The Contracts Department has had a considerably increased turnover, and orders continue to be received for larger installations.

The Chloride Electrical Storage Co., Ltd., is maintaining the interim dividend on its "A" and "B" ordinary shares at 5 per cent., payable on December 1st. The directors state that the trading results of the company and its associates continue to give satisfaction during the current financial year.

The Craigpark Electric Cable Co., Ltd., has decided to postpone the payment of the dividend on the 5 per cent. cumulative preference shares until the accounts for the year to March 31st are available. The dividend is in arrears as from October 1st, 1933.

S. Smith & Sons (Motor Accessories), Ltd., recommends a dividend of 2 per cent. and a further 7 per cent. on the non-cumulative preferred ordinary shares, making 14 per cent. for the year, and a dividend of 25 per cent. on the deferred ordinary shares. Similar distributions were made for 1933-34.

Edmundson's Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during October, as compared with the corresponding month of 1934, show an increase of 19 per cent. of kWh sold.

Vactric, Ltd., has recommended a final dividend of 7.763d. per ordinary share, making a total distribution of 10.763d. per share for the period from December 13th, 1934, to September 30th last. This is equivalent to 22½ per cent. per annum.

Associated Electrical Industries, Ltd.—It is reported that a city syndicate has purchased from American holders a block of about 170,000 £1 ordinary units of this company for a sum of about £300,000. This operation places the majority holding in British hands.

The North Somerset Electric Supply Co., Ltd., is holding an extraordinary meeting on December 4th at which resolutions will be submitted for converting the ordinary and preference capital into ordinary and preference stock.

The Western Electric Supply Co., Ltd., has announced a final ordinary dividend of 6 per cent., less tax, plus a bonus of 10 per cent., making 20 per cent. for the year. This is at the same rate as for the preceding year.

The British Electric Traction Co. has announced an interim dividend of 2½ per cent. on the deferred ordinary stock (same).

The Delhi Electric Supply & Traction Co., Ltd., is paying an interim dividend of 4 per cent. tax free (unchanged).

Stocks and Shares

TUESDAY EVENING.

GENERAL Election week cannot be expected to produce much interest in the way of Stock Exchange business. In anticipation of a substantial majority for the National party, quotations in most markets remained firm. In some parts of the House, a useful volume of business is going on. Stock Exchange firms find a ready willingness, on the part of investors, to consider with favour whatever attractive propositions are brought to their notice. The large spending programmes which have lately been outlined by the Government and the railways, play an important part in the stimulating of demand for shares in any of the industrial sections which are deemed likely to benefit from orders shortly to be placed. One of the outstanding features in the lists of securities with which we deal, is the strength of prices in the group for electrical manufacturing and equipment companies. Speculation has sprung up side by side with investment, and the activity of the two combined is a decided help in keeping markets liquid and in enabling buyer and seller to deal at close prices.

Gilt-edged Strength

The conviction remains unshaken that with the National Party practically assured of return to power, investment in gilt-edged stocks could go on unchecked. Accordingly, prices are holding their ground and showing, if anything, a better tendency. London Passenger Transport "B" is a point to the good; the "C" stock has risen 2. Central Electricity issues are rather irregular. London Electric Transport 2½ per cent. guaranteed has moved up to 97.

Associated Electrical Industries

Two very interesting events that have occurred within the last few days, concern the repatriation of shares in British

industrial companies from the United States back to this country. It is, of course, no more than continuation of what has been going on for some time past, but the amounts involved are sufficiently considerable to attract general attention. American holders have parted from a line of 170,000 ordinary shares of Associated Electrical Industries at a price that is understood to be about 35s. per share. This transfer still leaves the Americans with something like 40 per cent. of the company's ordinary shares; and, of these, probably a fair number will also cross the Atlantic as time goes on. So far from depressing the price of the shares on this side, the deal has bad the effect of putting up the quotation to 39s., around which considerable market activity has developed. On the basis of the last year's 6 per cent. dividend, the yield on the money is now very little more than 3 per cent., but the improvement in the price is due, naturally, to the expectation that the company will pay increasing dividends.

"Emmies"

The other block of shares which is about to come back from America is in Electric and Musical Industries. The Radio Corporation is understood to have sold the bulk of its holding in this company to British interests. The Electric and Musical Industries arose from the amalgamation of the Gramophone Company, H.M.V., and the Columbia Graphophone, a controlling interest in which was held by Victor Talking Machine, through which the Radio Corporation of America acquired its holding. Here, again, news of the proposed transfer had a strengthening effect upon the price of the Electric and Musical shares, which rose to 27s., optimism talking the price still higher. It may be recalled that not long ago a large line of General Electric ordinary shares was also repatriated and, prior to that, a block of Boots Pure Drug came across the Atlantic on a similar change of proprietorship.

American Utilities

While New York is thus parting from shares in British industrial companies, the Americans are substantial buyers of stocks and shares in their own utility companies. According to reports received from usually well-informed quarters, the American trade position is a good deal better now than it has been for some years past. Industry in all its branches is said to be going ahead; and, with the wheels of commerce revolving more freely, the purse-strings of the investor and of the speculator are opening to allow the transfer of capital into Stock Exchange securities. A number of the American utility companies that have been struggling along for some years past without making real headway, have been recently publishing improved returns, and in some cases have resumed payments of dividends. It would seem as though United States industry has started to revive, much in the same way as it did in this country some four years ago.

American Telephone and Telegraph shares at 152½ show a gain of 5 points. International Telephone and Telegraphs are a lively market in the neighbourhood of 12. Western Unions have come up quite lately from the neighbourhood of 60 to their present price of 73. Publication of net earnings for the quarter recently ended shows a very satisfactory advance in the figures.

Electricity Supply Shares

The few movements that have occurred in the prices of electricity supply shares are in favour of holders. The shares of the Scottish companies remain in demand. Clyde Valley and Scottish Power reflect the purchasing, with rises of 1s. and 1s. 3d. respectively. Amongst the provincial shares that have improved are those of the Lancashire Light and Power, North Eastern and Yorkshire Companies. Electric Finance and Security shares are better at 3 7/16. In the overseas group Calcutta Electrics at 64s. 3d. are 1/8 down on the week. Whitehall preference at 25s. again show a rise of 1s. 6d. Palestine A, in which there continues to be a good deal of business, are better at 49s. 9d.

Manufacturing and Equipment

Brush ordinary is 8 points up, at 49½, and has changed hands at over 50. British Insulated hardened to 91s. 3d. A rise of 4s. 6d. lifted Electric Constructions to 30s. 9d. Chloride Electrical A at 4¼ and the B at 4 7/8 are again better. Enfield Rolling Mills came into demand at 23s. 6d. Crompton Parkinsons rose to 94s., reacting later to 92s. 6d. The next board meeting, at which the dividend and bonus will be decided, will probably be held on Friday, November 22nd. After their sharp rise, General Electrics went back a few pence to 66s. 6d. Johnson & Phillips at 47s., Siemens at 25s. have gained a florin and 1/8 respectively. Johnson & Phillips new shares, now £1 paid, at 7s. premium are 1s. 6d. higher Ericssons continue a good market at 33s. 9d.

Miscellaneous Matters

The Cables and Wireless group has subsided into passivity but the A stock is a point better at 27. Marconi Marines remain popular with buyers and are 2s. 6d. higher at 37s. 6d. The iron and steel market keeps steady. Babcock & Wilcox hold their previous advance at 51s. 3d. Mexican Light and Power bonds are 5 up at 45. British Columbia Railway stocks have been wanted, and the 5 per cent. preference at 99½ is 2 points higher. British Electric Traction deferred put on 10. The rubber share market is very dormant.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend 1933.	Dividend 1934.	Price Nov. 12.	Rise or Fall.	Yield p.c.
						£ s. d.
Bournemouth and Poole	1	15	15	3¾	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 0
Clyde Valley	1	7	8	43/6	+1/–	3 13 7
County of London	1	10½	10½	54/6	—	3 17 1
Edmundson's 7% Pref.	1	7	7	36/–	—	3 17 9
Do. Ord.	1	7	8	42/–	—	3 16 0
Elec. Dis. Yorkshire	1	9	9	46/–	—	3 17 9
Elec. Fin. and Securities	1	12½	12½	3 7/16	+1/16	3 12 9
Elec. Supply Corporation	1	11	11	3½	—	3 10 3
Lancs Light and Power	1	7½	7½	38/–	+6d.	3 19 0
Lond. Assoc. Electric	1	—	—	34/–	—	4 2 4
London Electric	1	7	8	38/6	—	4 3 0
London Power deb. Red.	Stock	5	5	108½	—	4 12 4
Metropolitan	1	10	10	52/–	+6d.	3 17 0
Midland Counties	1	7	7	37/6	—	3 14 9
Mid. Elec. Power	1	8	8	41/3	—	3 17 6
North Eastern Electric Ordinary	1	6	6	34/–	+1/–	3 10 7
Do. 7% Pref.	1	7	7	34/6	+6d.	4 1 2
Northampton	1	10	10	51/3	—	3 18 0
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	31/6	+6d.	3 16 2
Scottish Power	1	8	8	42/6	+1/8	3 15 3
South London	1	7	7	33/6	—	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/–	+1/6	6 0 0
Yorkshire Elec.	1	8	8	43/6	+1/–	3 13 5

PUBLIC BOARDS.

Central Electricity, 1050–70	Stock	5	5	115	—	4 7 0
Do. 1955–75	"	5	5	117	—	4 5 6
Do. 1951–73	"	4½	4½	112	+1	4 0 4
Do. 1963–93	"	—	3½	101	–½	3 9 4
London Elec. Trans. Gtd.	"	—	2½	97	+1	2 11 8
London & Home Counties, 1955–75	"	4½	4½	114	—	3 19 0
London Passenger Transport, A	"	—	4½	120½	—	3 14 8
Do. do. B	"	—	5	127½	+1	3 18 5
Do. do. C	"	3½	4	104	+2	3 17 0
West Midlands Joint Elec. 1948–68	"	—	5	115	—	4 7 0

TELEGRAPH AND TELEPHONE.

American Tel. & Tel.	$100	9	9	152½	+5	5 18 0
Anglo-Am. Tel. Pref.	Stock	6 7/16	6 7/16	118½	+2½	5 1 5
Do. Def.	"	1½	1½	28	—	5 7 2
Cable & Wireless 5½% Pref.	"	2½	4½	103	—	4 0 0
Do. A. 7½% Ord.	"	Nil	Nil	27	+1	—
Do. B. Ord.	"	Nil	Nil	7½	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	13½	—	2 10 4
Do. do. Pref.	10	6	6	13½	—	4 9 0
Great Northern Tel.	10	20	20	39	—	5 2 7
Marconi-Marine	1	10	7½	37/6	+1½	4 0 0
Oriental Telephone Ord.	1	12	12	3 1/16	—	*3 18 4

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	9d.	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	"	5	5	1160	+10	—
Do. do. Pref. Ord.	"	8	8	168	+3	4 15 3
Brazil Traction	100	—	—	8½	+½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	+2	5 0 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	40	+5	—
Victoria Falls Ord.	1	20	20	3 1/16	+1/16	—
West Riding	1	5	6½	47/6	+5/6	2 14 9

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	10	15	60/–	—	5 0 0
Assoc. Elec. Ord.	1	4	6	39/–	+1/–	3 1 6
Do. Pref.	1	8	8	37/–	—	4 6 4
Babcock & Wilcox	1	6	8	51/3	—	3 2 6
British Aluminium Ord.	1	5	7½	42/6	—	3 10 7
British Insulated Ord.	1	5	15	4 3/16	+1/16	3 5 8
Brush Ord.	Stock	Nil	Nil	49½	+8	—
Callender's	1	15	15	3½	—	4 0 0
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	4½	—	0 13 7
Do. 8% Pref.	1	8	8	36/3	—	4 8 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	30/9	+4/6	2 5 10
Enfield Cable Ord.	1	25	25	5 1/16	—	4 18 5
English Electric	1	Nil	Nil	18/–	+6d.	—
Do. do. Pref.	1	Nil	Nil	22/6	—	—
Ericssons Tel.	5/–	—	24	33/9	+1/16	—
Ever Ready	5/–	35	35	23/3	—	7 10 4
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	10	66/6	–6d.	3 0 3
Henley's	1	30	30	6 3/16	—	4 6 3
Do. 4½% Pref.	5	4½	4½	5 1/16	—	3 16 8
India-Rubber Preferred	1	—	5½	1 1/16	—	4 17 9
Johnson & Phillips	1	5	7½	47/–	+2/–	3 3 10
Siemens Ord.	1	6½	4	25/–	+1/16	3 4 1
Telegraph Construction	£1	Nil	Nil	22/9	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and all subsequent proceedings will be taken.

1934

5027. "Radio receivers." Ferranti, Ltd., and M. K. Taylor. February 15th, 1934. (436856.)

7885. "Television and like systems and apparatus therefor." G. B. Banks and Baird Television, Ltd. March 13th, 1934. (436650.)

8335. "Control of gas or vapour-filled electric-discharge tubes." Siemens & Halske Akt.-Ges. March 16th, 1933. (Cognate applications 8336/34 and 8337/34.) (436651.)

8483. "Electromagnetic devices." H. Hausrath. March 17th, 1934. (436717.)

10351. "Overload release arrangements of automatic switches or circuit-breakers." J. A. Crabtree. April 5th, 1934. (436589.)

10828. "Electric transformers for regulating purposes." British Thomson-Houston Co., Ltd. April 10th, 1933. (Cognate application 10829/34.) (436718.)

11189. "Vapour-electric convertors." General Electric Co., Ltd., and E. Gallizia. April 13th, 1934. (436724.)

11213. "X-ray apparatus." W. E. Schall and R. J. M. Tozer. April 13th, 1934. (436593.)

11477. "Illuminating installation for aerials." Skoda Works, Pilzen, J. Svoboda and F. Raus. April 16th, 1934. (436664.)

11569. "Means for producing a direct-current voltage which is a function of another direct-current voltage." General Electric Co., Ltd., and H. H. Taylor. April 17th, 1934. (436798.)

11602. "Electrical amplifiers, such as may be used, for example, in television." A. D. Blumlein and C. O. Browne. April 17th, 1934. (436734.)

11803. "High-frequency signalling systems." Standard Telephones & Cables, Ltd. June 1st, 1933. (436870.)

11853. "Bayonet-joint locking-devices for electric-lamp holders." Midland Bank Executor & Trustee Co., Ltd. (Legal representatives of the late J. Etchells, and Associated Electrical Industries, Ltd. April 19th, 1934. (436596.)

11874. "Material for electrical insulating purposes." Callender's Cable & Construction Co., Ltd., and S. H. Cox. April 19th, 1934. (Cognate application 3898/35.) (436876.)

11945. "Telegraph systems and apparatus." Creed & Co., Ltd., A. E. Thompson and R. D. Salmon. April 20th, 1934. (436879.)

11969. "Automatic traffic-control systems." Automatic Electric Co., Ltd., and A. P. B. Renshaw. April 20th, 1934. (436883.)

12008. "Potentiometers." W. J. Clark, C. H. Bosanquet, R. A. Bell, R. Matthews and Imperial Chemical Industries, Ltd. April 20th, 1934. (436887.)

12030. "Composite units of inductance and capacity." E. K. Cole, Ltd., A. W. Martin, and H. Hunt. April 21st, 1934. (436808.)

12148. "Capacity-operated discharge lamp." Dr. C. Hummel. April 23rd, 1934. (436894.)

13029. "Electric stop actions for organs and the like." J. I. Taylor and J. Compton Organ Co., Ltd. April 30th, 1934. (436737.)

13114. "Methods of and apparatus for maintaining synchronism in television and like systems." T. M. C. Lance, and Baird Television, Ltd. May 1st, 1934. (Cognate application 25120/34.) (436809.)

13142. "Electric stop actions for organs and the like." A. H. Midgley and J. Compton Organ Co., Ltd. May 1st, 1934. (436739.)

14642. "X-ray apparatus." W. M. Burden, V. E. Pullin and A. R. Greatbatch. May 15th, 1934. (436745.)

15004. "Electrically operated fans." D. E. Rogers. May 18th, 1934. (436672.)

15198. "Electromagnetically actuated means for operating switch mechanisms of tramway or like systems." Forest City Electric Co., Ltd., and S. T. Quilliam. May 22nd, 1934. (436748.)

15743. "Arrangement of electric motor and gear mechanism." A. G. Rose and Northern Manufacturing Co., Ltd. May 26th, 1934. (436751.)

16025. "Street-traffic signalling systems." Siemens Bros. & Co., Ltd., and F. G. Tyack. May 29th, 1934. (436602.)

16407. "Electrically heated hot-plates." W. Needham and Associated Electrical Industries, Ltd. June 1st, 1934. (436603.)

16417. "Ship's telegraph arrangements." General Electric Co., Ltd., and A. W. Prinz. June 1st, 1934. (436904.)

16573. "Mounting of electric switches." R. H. Baker and C. W. Parsons. June 4th, 1934. (436604.)

16850. "Apparatus for recording sound by modulating radiant energy." Western Electric Co., Ltd. (Electrical Research Products, Inc.). June 6th, 1934. (Addition to 405078.) (436905.)

17563. "Radio receiving apparatus." E. K. Cole, Ltd., and A. W. Martin. June 14th, 1934. (436908.)

17793. "Electric water-heaters and steam boilers." S. A. Williams and F. J. C. Allen. June 15th, 1934. (436605.)

18055. "Electrical circuit-testing apparatus, more especially for wireless circuits." F. Perry. June 18th, 1934. (436909.)

18138. "Thermionic valves." E. Y. Robinson, J. Kay, and Associated Electrical Industries, Ltd. June 19th, 1934. (436606.)

18372. "Electrically operated changing display indicators." Siemens Bros. & Co., Ltd., J. H. Broome, and A. F. Wood. June 21st, 1934. (436675.)

18721. "Variable inductances." General Electric Co., Ltd., and C. G. Smith. June 25th, 1934. (436911.)

18903. "Electric fire and temperature alarm systems." Siemens Bros. & Co., Ltd., F. Turner, and H. J. Hadlow. June 27th, 1934. (436755.)

19294. "Electrical apparatus for heating fluids." G. H. C. Roux. June 29th, 1934. (436676.)

21507. "Control apparatus for electric-discharge devices." British Thomson-Houston Co., Ltd. July 26th, 1933. (436811.)

21651. "Luminous electric-discharge tubes." Claude-General Neon Lights, Ltd., and C. Higgins. July 24th, 1934. (436812.)

22319. "Apparatus for maintaining constant the current in an electric circuit." Landis & Gyr Akt.-Ges. August 31st, 1933. (436813.)

23676. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. August 16th, 1934. (436761.)

24237. "Method of and installations for electric spot welding." D. Sciaky. August 22nd, 1934. (Convention date not granted.) (436818.)

24309. "Electric-discharge devices." M-O Valve Co., Ltd., and L. H. Jones. August 23rd, 1934. (436819.)

25467. "Dynamo-electric direct-current machines of the commutator type." E. P. Hill and Associated Electrical Industries, Ltd. September 4th, 1934. (436917.)

25787. "Electromagnetically operated electrical contactors." A. West & Co., Ltd., and V. Breeze. September 7th, 1934. (436919.)

28358. "Fuse wire and fuse-wire leads for electric mine fuses." Dynamit-Akt.-Ges. Vorm. A. Nobel & Co. October 3rd, 1933. (Cognate application 28359/34.) (436763.)

29868. "Electric lighting installations." A. Colley & Bryce, Ltd. October 18th, 1934. (436921.)

30620. "Process for balancing out voltage fluctuations of direct-current sources." G. Krawinkel and W. Scholz. October 25th, 1933. (436764.)

30675. "Modulated carrier-wave circuit arrangements." Telefunken Ges. für Drahtlose Telegraphie. October 25th, 1933. (436922.)

30930. "Apparatus for measuring electric resistances." T. J. Ortenblad. October 27th, 1934. (436923.)

31631. "Flashlight lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 3rd, 1933. (436694.)

33281. "Thermally controlled relays." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. November 17th, 1933. (Cognate applications 33283/34 and 33284/34.) (436695.)

34530. "Electrical heating apparatus." F. Angell. December 1st, 1934. (Addition to 375054 and 410712.) (436696.)

36549. "Tabulating mechanism for printing telegraph apparatus." Creed & Co., Ltd. July 14th, 1934. (Cognate application 36550/34.) (436617.)

36829. "Electromagnetic relays." M. B. Richter (trading as Telefon Fabrik Automatic Ved M. B. Richter). December 22nd, 1933. (Cognate application 36830/34.) (436619.)

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1655. "Cathode-ray tube circuit arrangements." Telefunken Ges. für Drahtlose Telegraphie. January 30th, 1934. (436622.)

2793. "Electric incandescent lamps." General Electric Co., Ltd. February 24th, 1934. (436770.)

4143. "Electric control mechanism for stop motion devices in creels for warping frames and like textile machines." Maschinenfabrik Schweiter Akt.-Ges. March 29th, 1934. (436835.)

4370. "Telegraphic trunk-switching systems." Siemens & Halske Akt.-Ges. February 9th, 1934. (436624.)

5776. "Electric starting motors for internal-combustion engines." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. March 3rd, 1934. (436627.)

6283. "Variable resistance combined with a switch." L. Salamon and G. Stern. March 1st, 1934. (436628.)

7725. "Electron-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 18th, 1934. (436632.)

8159. "Radio receiving arrangements particularly suitable for use with radio beacons." C. Lorenz Akt.-Ges. August 14th, 1934. (436839.)

9421. "Indirectly heated cathode structures and electron-discharge devices incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. March 26th, 1934. (436712.)

9683. "Control of attenuation in electric signalling systems." Siemens & Halske Akt.-Ges. March 28th, 1934. (Cognate application 9684/35.) (436635.)

10119. "Thermionic valves." Delta Co. Schweizerische Prazisionsschraubenfabrik & Facondreherei. May 5th, 1934. (436636.)

11605. "Wireless aerials." J. T. Szek. September 25th, 1934. (436841.)

12961. "High-frequency electromagnetic wave transmitters." C. Lorenz Akt.-Ges. May 3rd, 1934. (436641.)

13008. "Electrical condensers." P. A. Sporing and Telegraph Condenser Co., Ltd. May 1st, 1935. (436642.)

14827. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 8th, 1934. (436848.)

17625. "Electric meters." British Thomson-Houston Co., Ltd. June 20th, 1934. (436787.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 6th.

Simms (lettering and design). No. 562922. Class 6. Machinery of all kinds and parts thereof.—Simms Motor Units, Ltd., Percy Buildings, Gresse Street, Rathbone Place, London, W.1.

Invicta. No. 562329. Class 40. Insulating tape composed principally of indiarubber.—Grout & Co., Ltd., St. Nicholas Road, Great Yarmouth.

Micanite for Commutator Separators

A British Standard Specification has recently been published for micanite for commutator separators to safeguard the purchaser from having micanite built from very small splittings. It is based on research carried out by the Electrical Research Association and it is laid down that not less than a given proportion of the splittings in a sample of stated size shall have a rectangular area of ¼ sq. in. or over, this figure taking account of breakages during manufacture, etc. This limitation together with a stability (tendency to slippage) test under heat and pressure and an electric strength test, hot, should ensure a commutator micanite of satisfactory commercial quality, though admittedly not the best that can be made. Copies of this Specification (No. 626, 1935) can be obtained on application to the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Addlestone.—Houses (378), Wey Manor estate; R. F. Bartlett.
Ashton-under-Lyne.—Public library, Crickets Lane; borough surveyor.
Bacup.—Houses (50); borough engineer.
Barrow.—Cinema (2,000 seats), near the Central Railway Station (£48,000), for James Brennan; Drury and Gomersall, architects.
Bexley.—Houses; U.D.C. surveyor.
Bishop Auckland.—Houses (54), small holdings (£21,330); A. Elcoat & Son, Durham.
Blackpool.—Baths and health centre, Pembroke estate (£150,000); borough engineer. School centre, Tyldesley, for E.C.
Bridgwater (SOMERSET).—Houses (40), Kendale Road; borough surveyor.
Bristol.—Houses (48), Southmead estate (£14,842); John Knox, Ltd. Factory, Bath Road, for Smith's Potato Crisps, Ltd. Laundry, dairy and general engineering repair works, Bath Road, for the Bristol Co-operative Society, Ltd.
Burnham (BUCKINGHAMSHIRE).—Houses (22), near Gore Lane, for W. G. Eyles.
Burnley.—Houses (96), flats and bungalows, Bleak House estate; borough surveyor.
Camborne (CORNWALL).—Houses (34); U.D.C. surveyor.
Chelmsford.—Houses (62), Millfield estate; City and Borough Housing Corporation, Ltd. Swimming pool (£20,000); borough engineer.
Cheshunt.—Houses (26), College Road, for Bennett Burleigh. Shops, Cambridge Arterial Road and College Road, for the Enfield Highway Co-operative Society, Ltd.; secretary.
Chiswick.—Two factories, Great Chertsey Road and Burlington Lane, for the Chiswick Products, Ltd.
Chorley.—Covered market; borough surveyor.
Clacton-on-Sea.—Concert hall, café, &c.; W. Aiston, U.D.C. surveyor.
Cobham.—Cinema, near the White Lion Hotel (£15,000); Savoy (Cobham), Ltd.
Coventry.—Central library, art gallery, museum and courts of justice; city engineer. Junior school, Wyken; director of education, Council House. Enlargement and modernising of the L.M. & S. Railway Station with electrical work (£500,000); company's survey department.
Darlington.—Church, Brinkburn Road; L. C. Abdale, builder, 52, High Northgate.
Dewsbury.—Houses (33), Staincliffe, for P. Ward & Co.
Durham.—Houses (24), Sherburn Road, for the Church Army, 55, Bryanston Street, London, W.1. School of Agriculture, Houghall, for C.C.; W. Carter, architect.
Edinburgh.—Houses (364), North Saughton Road; McTaggert & Michel, Ltd., 65, Bath Street, Glasgow.
Essex.—Schools, Harlow, and Boys' High School, Buckhurst Hill (£50,944), for County E.C. Reconstruction of Shire Hall, Chelmsford; county architect.
Failsworth.—Houses (24), Dean Street; J. W. E. Brown, U.D.C. surveyor.
Filey.—Houses (82), adjoining Scarborough Road; Welford B. Gofton, Council Offices.
Fort William.—Hotel (40 bedrooms) (central heating), Gordon Square; G. Marshall Spence, Fort William.
Friern Barnet.—Houses (28), Church Crescent; H. Seymour Couchman & Sons, 520, High Road, N.17.
Gloucester.—Technical college (£63,000), Brunswick Road; Dr. H. J. Larcombe, education officer.
Godstone.—Houses (117), Bletchingley; S. Easter, R.D.C. surveyor, Oxted.
Gravesend.—Senior schools, for the trustees of the King St. Old National School Foundation; borough architect.
Greenfield (NEAR HOLYWELL).—Factory; Courtaulds, Ltd, 16, St. Martins-le-Grand, London, E.C.1.
Hailsham (SUSSEX).—Houses (115) and shops, Stud Farm estate, Polegate, for the Mile Oak Estates, Ltd.
Hampton (MIDDLESEX).—Plant and machinery at waterworks (£69,800); Metropolitan Water Board.
Hastings.—Additions, including pathological department and theatre unit, Royal East Sussex Hospital; Callow & Callow, architects, 47, Havelock Road.
Hertfordshire.—Schools, Baldock and Sandon, for County E.C.
High Wycombe.—Furniture factory; Castle Bros. (Furniture), Ltd.; W. J. Castle, chairman.
Hull.—Shops, Cranbrook Avenue and Greenwood Avenue; city architect. Extensions to works, Southcotes Lane; F. Robinson & Co., Ltd.
Kent.—Mixed central school, Herne Bay and Whitstable, for County E.C.
Ketton.—Houses (34); G. Dolphin, architect, North Street, Uppingham.
Lancashire.—Senior school, Kearsley (£37,200), for County E.C. Extensions to Park Hospital, Davyhulme, for C.C.
Lancaster.—Extensions to baths (£41,000); borough engineer.
Larbert (STIRLING).—Houses (60); A. W. Malcolm, Council Buildings, Stirling.
Leeds.—Reconstruction of Victoria Cinema and shops, York Road; Goldstones Cinemas, Ltd.
Lewes.—Houses (28); A. Saunders, builder, Brighton.
London.—(BERMONDSEY).—Remodelling, Secondary School (£26,953); Prestige & Co., Ltd., 149, Grosvenor Road, S.W.1. (WANDSWORTH).—Municipal offices, High Street (£278,000); borough engineer. (WESTMINSTER).—Reconstruction of Buckingham Gate Central School (£22,933); Truett & Steel, Ltd., 71, High Street, Thornton Heath, Surrey.
Luton.—Extensions to factory for C. Clay & Sons, Ltd., Waldeck Road.
Mansfield.—Houses (199), and shopping centre, Sutton Road, for Radford & Jenkins.
Middlesex.—Technical institute, Twickenham; county architect, Tufton Street, London, W.
Mildenhall.—Houses (32), London Road; R.D.C. surveyor.
Newburn-on-Tyne.—Houses (52), Lemington; U.D.C. surveyor.
Newcastle-on-Tyne.—Houses (34), Turret Road, &c.; E. Jeffcock, builder, Claremount Road, Lemington. Houses (26), Severas Road; W. Smelt, builder, West Road. Flats (140), Granville Road (£200,000); Cussins, Ltd., builders, Grange Park estate, Gosforth. Extensive alterations to premises, Bath Lane, for the Paramount Film Services, Ltd.; J. N. Fatkin, architect, 17, Bigg Market.
Oldham.—Factory for A. G. Garments, Ltd., Manchester.
Orrell.—R.C. senior school, for St. Robert Bellarmine parish.
Oxford.—Houses (115), Wolvercote; F. O. Farnworth, builder, Moreton-in-the-Marsh.
Peterborough.—Radio service factory, Peakirk (electrical work), for Leslie Neaverson, Radio House, Cowgate.
Plymouth.—Houses (518), Weston Mill estate; Davis Estates, Ltd.
Pontefract.—Houses (100); borough surveyor.
Portsmouth.—Infants' and junior schools (400 places each), Court Lane, Cosham, and Wymering, for E.C. Reconstruction of Apollo Cinema; manager.
Princes Risborough.—Factory for A. E. J. Way, Denmark Street, High Wycombe.
Redditch.—Houses (46), Easemore Road; C. E. Round. Houses (56), Studley Road; Mr. McWhirter.
Renfrewshire.—School (350 places), Eaglesham, and additions to Netherlee School, for County E.C.
Rickmansworth.—School, Mill End (£21,772); Melville, Dundas & Whitson, Ltd.
Rochdale.—Houses (230), Brotherod; S. H. Morgan, surveyor, Town Hall.
Rochester.—Houses (100); city surveyor.
St. Helens (LANCASHIRE).—Houses (169), Nutgrove estate; H. Scott.
Saltburn.—Cinema, assembly room and café; J. Hinge, 72, Grey Street, Newcastle-on-Tyne.
Sheffield.—Houses (20), near Ridgehill Avenue; Hallewell Estates, Ltd. Reconstruction of cathedral (£100,000); Provost A. C. E. Jarvis.
Shifnal.—Houses (72); R.D.C. surveyor.
Slough.—Houses (444), near Bath Road, Cippenham, for Economic Housing estates. Factory, Mill Street, for A. T. Ricketts.
Southam.—Houses (24), Harbury; G. Hunt, builder, Shipston-on-Stour.
South Shields.—Houses (468), Prince Edward Road; J. Reid, borough engineer. Clinic, Stanhope Road; M. J. Glover, 53, King Street.
Stafford.—Houses (60), Weston Road, for L. T. Taylor, Wolverhampton.
Stockport.—Houses (40), Torkington estate; Pennington Bros., builders, Offerton Road, Torkington.
Stockton-on-Tees.—Houses (63), Durham Road, and Municipal Buildings three storeys high; borough engineer.
Stoke-on-Trent.—Houses (90), Longton Hall estate; J. & F. Wooton, Ltd. Extensions to North Staffordshire Technical College, and new colleges of art and commerce (£200,000); schools, Blurton (£41,600); Carmountside (£31,600); Chell (£21,000), Goldenhill (£10,000), Stanfield (£10,000), Meir (£50,000), Thistley Hough (£51,140), and extensions Meir junior school, for E.C.
Sunderland.—Houses, Hylton Road; borough engineer.
Surrey.—Two schools, Epsom (£31,495), for County E.C.
Teddington.—Studio, dressing rooms, power house and offices, Broom Road; Warner Bros., First National Productions, Ltd.
Torquay.—Houses (107), Thatcher Rock estate; Dashwood & Partners.
Tottenham.—Reconstruction of North Eastern Hospital (£157,786); Leslie & Co., Ltd., Kensington Square, W.8.
Twickenham.—Houses (138); Eadie & Co., builders, Wolverhampton.
Tyldesley.—Houses (100), Astley Housing estate; F. E. Jones, surveyor, Town Hall.
Warwickshire.—School (200 places), Kenilworth; director of education, Warwick. Extensions to mental colony, Weston (£55,000); county architect.
Wednesbury.—Houses (26) and shops, Short Street, with electrical work; A. Booth, borough surveyor, Town Hall.
West Hartlepool.—Cinema, Hart Road, for Associated British Cinemas, Ltd., Golden Square, London, W.1 (£40,000).
West Riding.—School (240 places), Barugh Green, Darton; director of education, Wakefield.
Wick.—Cinema, for Caledonian Associated Cinemas, Ltd.; Messrs. Cattanach, architects, The Laurels, Kingussie.
Windsor.—Aerodrome, with flying school, club houses, &c., Winkfield, for Aircraft & Autos, Ltd.; L. E. H. Perry, director. County School buildings, for E.C. (£100,000).
Winsford (CHESHIRE).—Houses (30); U.D.C. surveyor.
Wolverhampton.—Cinema, Falling's Park; R. Satchwell, architect, 6, New Street, Birmingham. Electricity showrooms, Darlington Street, for the Wolverhampton Corporation.
Worthing.—Houses (176), Durrington estate (£63,081); Willmore Phillips, Ltd. Houses (20), Sompting (£5,960); D. A. Hopper, Patcham.
York.—Cinema, Blossom Street; Odeon Cinemas, Ltd.